

ALAGAPPA UNIVERSITY

[Accredited with 'A+' Grade by NAAC (CGPA:3.64) in the Third Cycle]
(A State University Established by the Government of Tamil Nadu)
KARAIKUDI – 630 003
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DIRECTORATE OF DISTANCE EDUCATION



200

Master of Business Administration



M.B.A. (Logistics Management)
Paper 3.5

Rail-Road Logistics

RAIL-ROAD LOGISTICS

MBA [Logistics Management]

Paper 3.5



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Karaikudi - 630 003 Tamil Nadu, India

SYLLABI-BOOK MAPPING TABLE

Rail-Road Logistics

Syllabi	Mapping in Book
UNIT I **Transportation in Logistics:** Significance of Transportation in Logistics: Utility Created by Transportation in Logistics-Transportation as a Means of Conquering Time and Space-Features of Inbound, Outbound, Local and Medium, Long and Continental Transportation-Features of Logistics Transportation-Advances in Logistics Transportation.	**Unit 1:** Transportation in Logistics **(Pages: 3-26)**
UNIT II **Railways and Logistics Contours:** Features and Facilities Offered by Railways-Factors Influencing Growth in Rail Logistics-Suitability for Different Cargo and Distance Ranges segments-Innovative Schemes/Facilities to Popularize Rail Logistics in India-Railway Infrastructure in India and Freight Movement-Share of Railways in Cargo Movement in India and Worldwide.	**Unit 2:** Railways and Logistics Contours **(Pages: 27-52)**
UNIT III **Railways and Logistics Economics:** Freight Determination for Cargo in Railways-Freight Levels and Rail-Cargo Elasticity-Route Scheduling-Cargo Consolidation-Arrangements for Pooling at Rail Head and Distribution from Rail Head-Dedicated Rail-Sidings for Bulk Users-Technology, Cost, Speed, Secuiity and Dynamics-Competition with Other Modes.	**Unit 3:** Railways and Logistics Economics **(Pages: 53-75)**
UNIT IV **Roadways and Logistics Contours:** Roadways as a Primary Mode and Complementary Mode of Transportation in Logistics-Features, Facilities and Suitability-Innovations in Road ways to make it Logistics-Friendly-Factors Influencing Choice-Factors Influencing Growth in Road Logistics-Suitability for Different Cargo and Distance Ranges Segments-Innovative Schemes/Facilities to Popularize Rail Logistics in India-Share of Roadways in Cargo Movement in India and Worldwide.	**Unit 4:** Roadways and Logistics Contours **(Pages: 77-99)**
UNIT V **Roadways and Logistics Economics:** Roadways Freight Rate Determinants-Freight Levels and Road-cargo Elasticity-Own Fleet: Capacity Counters, Maintenance, Scheduling, Freight Consolidation, Return and Reverse Logistics in Road Logistics-Road Infrastructure and Logistics issues-Role National Highways and the Toll Highways-Outsourcing Fleets from Others-Technology, Cost, Speed, Security and Dynamics-Competition with Other Modes.	**Unit 5:** Roadways and Logistics Economics **(Pages: 101-123)**
UNIT VI **Coordination among Different Segments:** Concept, Need and Areas of Coordination Among Different Modes-Coordination Among Supply Chain Partners- Energy Product Prices and Logistics-Environment and Logistics-Problems and Prospects in Interstate Logistics by Road-Role of Truckers' Bodies in Road Cargo Movement.	**Unit 6:** Coordination Among Different Segments **(Pages: 125-146)**

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INTRODUCTION

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Logistics is defined as the method of managing and controlling the flow of goods, energy, information and other resources such as products, services and people from the source of production to the end destination. Logistics is also defined as 'time related positioning of resources'.

Logistics has a tremendous impact on the domestic and global economies. Logistics facilitates market exchanges, provides a major source of employment and is a major purchaser of assets and materials. Logistics is absolutely essential for human survival. Logistics influences your quality of life. The logistics industry employs people worldwide, ensuring a cost-effective means of distributing goods locally and globally. Logistics enables many activities. Besides the flow of industrial and consumer products, logistics also affects other activities.

Transportation creates time and place utility in goods. Logistics costs are in the range of 12–15 per cent of the GDP for a developing country while it is around 18–20 per cent for a developed country. The difference, apart from reflecting the country's geography, is due to better customer service parameters and, in fact, a better material quality of life in the developed countries. Customer sensitivity has been moving along similar lines in India, with aspirations for improved service and material quality of life. Effective transportation systems play an important role in making this possible. The three basic transportation modes used in India are:

- Roads,
- Railways
- Water
- Airways

The book, *Rail-Road Logistics* has been divided into six units. Unit 1 deals with the significance of transportation in logistics, features of inbound, outbound, local and medium, long and continental transportation, features of logistics transportation and advances in logistics transportation. Unit 2 deals with the features and facilities offered by railways, factors influencing growth of rail logistics, suitability of railways for different cargo and distance range segments, innovative schemes/facilities launched by the Railways Ministry to popularize rail logistics in India, railway infrastructure in India and freight movement and the share of railways in cargo movement in India and worldwide. Unit 3 discusses the general principles for assessing railway freight policy and describes the various benefits of cargo consolidation. This unit will also deal with the concept of route scheduling. Unit 4 discusses roadways as the primary mode and complementary mode of transportation in logistics, innovations in roadways to make it logistics-friendly, factors influencing the growth of road logistics and so forth. Unit 5 helps to understand concepts such as freight rate determinants in roadways, capacity counters, maintenance, scheduling, freight consolidation, return and reverse logistics in road logistics, road infrastructure and logistics issues and competition of roadways with other modes of transport. Unit 6 states the need and areas of coordination among different modes, coordination among supply chain partners, energy product prices and logistics and role of truckers' bodies in road cargo movement.

The book has been written in keeping with the self-instructional mode or the SIM format wherein each Unit begins with an Introduction to the topic, followed by an outline of the Unit Objectives. The detailed content is then presented in a simple and organized manner, interspersed with Check Your Progress questions to test the student's understanding of the topics covered. A Summary and a set of Questions and Exercises is provided at the end of each Unit for effective recapitulation.

UNIT 1 TRANSPORTATION IN LOGISTICS

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Structure

1.0 INTRODUCTION

Transportation and logistics is all about comparing the details of travel, and the complex dynamics behind moving people or goods from place A to place B. Logistics deals with organizing the movement of goods, services or any equipment. Let us now try and understand transportation and logistics management. Transportation and logistics management is the movement of people, animals and merchandises from one place to another. Means of conveyance may include air, rail, road, water, towline, pipe and space. Transport is vital because it makes trade between people possible which in turn leads to growth of economy. As per the APICS dictionary, logistics has been defined in two ways: a) In an industrial setting— the art and science of obtaining, producing and distributing material and product in the proper place and in proper quantities. b) In a military way (where it has greater usage), its meaning can also include the movement of personnel. The Council of Supply Chain Management Professionals (CSCMP) has defined logistics as the process of planning, implementing and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements. This definition includes inbound, outbound, internal and external movements.

1.1 UNIT OBJECTIVES

After going through this unit, you will be able to:

- Prepare an overview of transportation in logistics
- Analyse the significance of transportation in logistics

- Discuss the features of transport
- Describe the features of logistics transportation
- Identify the advances in logistics transportation

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1.2 TRANSPORTATION IN LOGISTICS: AN OVERVIEW

Having understood the terms transportation and logistics, let us now understand the differences between the two of them. We now need to understand whether they are the same thing? After going through the definitions of these terms, it is not very difficult to see the difference between the two of them. Transportation provides direction to logistics, but logistics provides speed to transportation. In fact, the following sentence makes the difference even more clear. Logistics needs planning, whereas, transportation is just the means to implement the plan, while transporting merchandise from place A to place B. Undoubtedly, they are not the same thing, but to put it simply, transportation is a part of logistics. When we talk of logistics, executives concerned with logistics must make further decisions beyond the means of transportation to include the following:

- Packaging
- Containerization
- Documentation
- Insurance
- Storage
- Importing and exporting regulations
- Freight damage claims
- Working and collaborating with other executives within the supply chain
- Managing vendors and partners



Containerization: It is a system of intermodal freight transport using intermodal containers. The containers have standardized dimensions.

The process of transportation governs the effectiveness of moving goods. The advancement in procedures and organization's policies advances the movement of load, speed of delivery, quality of service, costs of operation, the usage of facilities and conservation of energy. Transport plays an important role in the management of logistics. Studying the existing condition, a robust system requires an unambiguous logistics framework and an appropriate transportation system implements the techniques to link all procedures.

With the commencement of liberalization globalization and privatization in the present century, the prominence of logistics management has increased in different areas. As far as the industries are concerned, logistics helps to augment the current processes of production and distribution, based on the same means by way of management techniques for stimulating the proficiency and competitiveness of industries. The key component in a logistics chain is the transportation system, which joins the disconnected activities. Transportation occupies one-third of the expenditure of logistics and transportation systems impact the performance of logistics system immensely. Transporting plays a crucial role in the entire procedure of production from manufacturing to delivery.

Check Your Progress

1. Mention the various important concepts that are covered under transportation in logistics.
2. State one difference between logistics and transportation.

1.3 SIGNIFICANCE OF TRANSPORTATION IN LOGISTICS

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Transportation is one of the more essential activities in the conduct of a business. By moving goods from places where they are manufactured to places where they are in demand, transportation gives the necessary provision of joining an enterprise to its contractors and clients. It is an indispensable activity in the function of logistics, providing support to the economic utilities of space and time. Place utility means that customers have the goods available at the place of demand. Time utility means that clients get the product as and when they demand it. By working in close association with inventory planners, professionals working in the transportation field seek to confirm that the corporate has merchandise available where and when customers demand.

At times, the failure of the business to serve its customers properly may be a result of several factors. Late supplies can cause service problems and can be the reason for complaints from its customers. Products may also be damaged in transit, or at the warehouse. Such over, short, or damaged (called OS&D) shipments can be a cause of frustration to the customers, in addition it may lead to dissatisfaction and the decision not to purchase goods from that particular company in the future.

Nevertheless, in case of a company performing on time with entire and unspoiled deliveries reliably, this can inculcate customer assurance and improve business for the company. When a company inspires assurance in service performance, it can make customers more hesitant to yield to competitors' bids to take away business through ingenious promotions and cheap prices.

Faster means of transport usually turn out to be more expensive than slower means of transport. So while delivering an order overseas by aircraft is much quicker than delivery by ship; it may cost as much as 20 times more. Such a difference in the cost may not warrant the use of the quicker means of transporting the goods. It is, therefore, essential for supply chain managers to carefully deliberate upon the cost of shipping goods when deciding when and how to move goods in the most cost-effective manner.

Let us now have a look at the following aspects:

- The basic ideas of transportation management and its critical role in the fulfillment of demands.
- Ascertain the vital basics and procedures in managing transportation processes.
- Ascertain principles and policies for establishing efficient, effective, and maintainable transportation processes.
- Elucidate the important role of technology in managing transportation operations and merchandise flows.
- Define the necessities and challenges of planning and transporting goods from one country to another.
- Deliberate how to evaluate the performance of transportation operations using standard metrics and frameworks.

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As discussed earlier, logistics is defined as 'that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information from the point of origin to the point of consumption in order to meet customers' requirements.' In this expression, transportation has been denoted by the word flow. Transportation offers the flow of inventory from the place of origin in the supply chain to the place of destination. Most enterprises deal with both, inbound and outbound logistics. Inbound transportation logistics encompasses obtaining supplies and goods from the location of the suppliers. Outbound transportation logistics encompasses the supply of goods to the location of the customers.

At times, inventory flows in the opposite direction, reverse transportation logistics denotes — the role of logistics in reutilization, materials replacement, recycle of materials, waste removal, renovation, restoration and remanufacturing of products. Hence, transportation not only sends material and goods to consumers but also transports reusable and recyclable goods to businesses that can make use of it.

1.3.1 Utility Created by Transportation in Logistics

The role of transportation in logistics is more complicated than simply transporting goods. Its complexity can be handled only through highly quality management. By means of a well-handled transport system, goods can be easily sent to the right place at the right time in order to satisfy customers' demands. It brings efficiency, and furthermore it bridges the gap between the producers and customers. Hence, transportation enhances the competence and economy in business logistics as well as other aspects of the logistics system. Moreover, a good transport system functioning in logistics activities benefits not only the service quality but also the company's competitiveness. Transportation encompasses the physical movement or flow of merchandises. The transportation system is the physical link that joins consumers, suppliers of raw material, plants, warehouses and other members of the channel. These are the fixed points in the logistics supply chain.



Multimodal transport: It refers to a combination of at least two means of transport.

Water, rail, road, air and pipeline are the basic means of transportation. Water being the slowest mode of transportation followed by rail, road, and air in terms of speed of delivery. Usually, the order is inverted while seeing cost-effectiveness. Selection of the suitable carrier includes many steps. First of all, the company chooses a means of transportation. The shipper must compare the required service with the rate or cost being asked for. Service typically includes the transit time or the time that passes from the time the consignor makes the goods available for dispatch until the carrier delivers them to the consignee in an intact condition. Pickup and delivery, terminal handling and movement between the origin and destination account for the time involved in shipping the goods.

The organization must place stability between the 'need for speed' and 'the cost-effectiveness' of the mode of transport. This consists of the charges for the service, minimum weight required, loading and unloading services, packing, likely damage in transit, and any exceptional services that might be desired or needed. In case of a compulsory next day delivery, the transporter will use an air cargo carrier but will have to pay a premium price for such express service. If time is not the most important

element then the transporter may choose to utilize rail or a road carrier, or may even use seaways, if there is no urgency of time. Water-based means of transport are the most inexpensive and are utilized for commodity type goods such as grain, coal and ore. Some organizations also use more than one means of transport, this activity is called multimodal transport, to move their goods.

After selection of the means of transportation, the consignor must select the legal arrangement or type of carrier they wish to use: common, contract, exempt or private. Let us now study each one of them briefly.

- Common carriers are those which offer transportation services to the general public at affordable prices. They are not authorized to refuse to carry a specific article of trade or refuse to deliver goods to a particular point within the ambit of its operation.
- A contract carrier does not serve the general public, rather, it serves one or a limited number of consumers. They have no legal service onus. They generally offer a particular service and usually have lower rates than common or regulated carriers.
- Exempt carriers are those which are exempted from regulation concerning rates and services. Exempt status comes from the type of commodity carried or the nature of the carrier's operation. Exempt road carriers are generally local and usually convey such things like agricultural goods, newspapers, cattle and fish. Exempt water carriers transport bulk commodities such as coal, ore, grain and liquid. Exempt rail carriers transport piggy-back shipments and exempt air carriers haul cargo.
- A private carrier means an organization's own means of transportation. Private carriers cannot be hired by anybody and are not subject to the same national rules as those binding on other types of goods carriers. They are used by the owner firm for transportation of their goods or personnel.

Logistics encompasses forecasting demand, planning inventory, and storing goods along with delivering them. Enhanced logistics performance shows that these activities are working well in unison so that the customer of the logistics service is satisfied with the service, yet the cost borne by the company is minimalized. This optimum performance needs an understanding of how the various logistical decisions and actions have an effect on the service provided to customers and the total cost incurred.

1.3.2 Transportation as means of Conquering Time and Space – Benefits of Transportation Management System (TMS)

There are many benefits of the Transportation Management System (TMS) recognized by the industrialists, distributors and businessmen. A transportation management system facilitates businesses to move consignments from the origin to the destination quickly, efficiently and economically. TMS includes solutions for moving merchandise by all means and also includes multimodal/intermodal movement of freight. The TMS procedures comprise inbound or outbound, domestic or international transportation of freight; by means of transportation equipment possessed by the company or an external service provider. The cargo managed by a TMS may range in size from small parcels to bulk freights.

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Possibly no other supply chain presentation proposes so many methods to save money or attain value. But the foremost reason why businesses make use of a TMS is to reduce space to send freight. A TMS attains these savings accrued from process implementation, analytics and optimization; with practically no other supply chain application offering so many different kinds of optimization. There is a specific emphasis on the extent to which a TMS can reduce spending on freight. Numerous methods can be used to decrease freight cost, with the diverse 'savings buckets' having different levels of savings.

Transporters who implement TMS solution in comparison to the traditional methods of transportation management are able to show better performance in terms of service levels and savings on freight. We have been able to ascertain the benefits of transportation as a means to conquer time and space. Let us now examine few other areas where there are additional benefits of TMS.

- **Increased Customer Service:** Equipped with the ability to use a TMS with reporting and analytics the transporter is able to view the effect of his/her choices within that TMS.
- **Warehouse Efficiency:** Benefits of TMS usage in enhancing warehouse efficiency are manifold. Increased usage of transportation management system decreases the time required for freight management because of which more time can be spent working on other projects, for example, warehouse duties.
- **New Delivery Capabilities:** A strong TMS provides the ability to enhance the way a consignment is shipped. A Transportation Management System allows you to effortlessly generate a Master Bill Of Lading (MBL) and you can have individual log in IDs with your numerous locations which can then be dealt with by one person.
- **Inventory Reductions:** On getting a reassurance from the TMS being utilized that all customers are receiving their shipments on time, it allows you to plan improvement for the inventory waiting in line. Having a precise estimate of your inventory is ever more important today, as e-commerce freight shipping remains to increase for the predictable future.
- **Cash Flow Improvements:** By employing proper freight accounting, through freight payment, auditing and consolidation services, within a TMS solution, a shipper can improve the cash flow largely.

1.4 FEATURES OF TRANSPORT

A well-designed and well-planned transport system could include enormous and well-organized networks like airports, sea ports, railway stations and bus stops. Road transportation may even comprise movement by foot, by cycle, and usage of small vehicles like cars. For effective transport, the consignor must select the appropriate mode of transport depending upon the size of the shipment and the urgency of time. A multimodal road transport system may be used proficiently as different kind of transportation may be required for transporting people or freight. Each mode of transport has a separate path for its travel. This provides speed and efficiency to transport. So, multimodal transportation is one of the features of transport which renders efficiency to the system.

Check Your Progress

3. What is a Transportation Management System (TMS)?
4. What are common carriers?

Pricing is another important feature which plays a crucial role in transportation. Competent pricing for travelling, shipping goods, fuel consumption and other factors make the transportation system very efficient.

Well drawn out policies favour better transportation which results in an efficient transportation system.

By making improvements in transportation, efficiency of the entire logistics system can improve. Efficient management of transportation plays a vital role in determining the success rate of an organization.

Transportation incurs enormous expenses to a company thereby making it try hard towards achieving maximum returns on investment. Adoption of automatic solutions by companies in such situations expedites optimization of determined activities thereby broadening their line of operations and adding worth to their supply chain. A well-formulated Transport Management system contributes to the success of a business globally through effective management of freight flows and increased efficiency throughout the distribution network.

Important Features of Transport Management System

Features of a competent transport management system that contribute in making a supply chain improved can be broadly categorized into three classifications:

i. Optimization
ii. Execution
iii. Performance management

1. Optimization

- **Route Optimization and Linking:** The transport system must be designed to offer the most ideal routes to the carriers. It must have the capability to at once manage to plan and implement routing for numerous shipments either by combining, merging, or even for multimodal transportation activities. Merging shipments not only saves money but also avoids unnecessary and unproductive multiple trips which helps in preservation of fuel and reduction in carbon emission.
- **Selection of Means and Carrier:** This feature supports appropriate selection of most promising carrier and means of transport grounded on service needs in terms of charge, competence and distance. The system must be designed to automatically choose the best carrier from central data pool based on past performance, price and business needs.

2. Execution

- **Integrated warehouse management system (WMS):** The integration of WMS element with the prevailing transportation management system offers real-time information about warehouse facilities like goods tracking, shipment dispatch many such significant performance pointers. Contact with such real-time information increases the process of decision-making.
- **Integrated Electronic Data Interchange (EDI):** EDI is a standard format for exchanging business data. Firms achieve better transparency in their functions and experience noteworthy decrease in tedious and time consuming paper work.

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Electronic data interchange (EDI): It is the computer-to-computer exchange of business documents between organizations.

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Incorporation of EDI in the Transport Management System offers high end correctness in data and provides swiftness in important information exchange between the industries and at the same time contributes significantly to create a green supply chain.

- **Unified audit and payment module:** Auditing and payment systems permit a TMS to estimate the freight charges, assess the service choices and recognize the areas of improvement.
- **Multi-modal transportation facility:** A transport management system must be equipped with features like improved geo-coding, support for rail, air, ocean centered multimodal transport system. In addition, a global map and guide permits freight to be conveyed by means other than road transport, thus, enabling cross border business.

3. Performance management

- **Track & Trace:** This feature in a TMS, permits real-time exchange of shipment information between the carrier, consignor and consignee. Carrier companies have their internal software equipped to track the movement of shipment during the transit period. Through this method of track and trace, the carrier monitors the movement of the shipment till its final delivery to the consignee.
- **Visibility:** Visibility feature gives a detailed view of every step of the shipping procedure. Precise and well-timed visibility of the important information of the whole supply chain empowers to maintain a good balance between demand and supply through positive administration of the flow of goods. Thus, the overall cost of transportation can be decreased.
- **Business Intelligence and Analytics:** This feature includes skillful use of data warehousing, dashboard functioning and generating reports in standard or custom designs. Its aim is to collect, analyse and summarize supply chain data to use it in a resourceful manner for effective decision-making, identifying needs and key areas of functional improvement, and assessing the efficiency of prevailing strategies.

1.4.1 Inbound Transport

Since the years gone by, the relationship between the consignor and the consignee has been immensely significant. At many firms, inbound consignments are just seen on the dock. Companies do not have much control over when and how the goods are transported, and also come across little opportunity to make it more efficient.

Improving upon the control mechanism brings along many benefits that can help firms decide in a better way where and how to route and bring together inbound shipments in order to enhance savings.

All said and done, the final objective of any inbound procedure is to receive material as soon as possible, without exclusion, so that it can either be moved for production to the manufacturer or or into stock for sale, at the most economical cost.

Preparation of a routing guide is the first step towards developing healthy inbound transport mechanism. A routing guide outlines the guidelines of arrangement between the manufacturers and consumers. The guidelines of arrangement are actually a manual

of business rules related to the operating conditions according to which businesses work. The guidelines of arrangement also work as the basis through which compliance is streamlined and applied, and ought to serve to hasten the flow of information and resources.

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The following 10 steps help in creating an effective inbound routing guide:

Step 1: Organization of present and future consignments in terms of the origin and destination.

Step 2: Identification and charting of expense/service abilities and restrictions of every transport carrier, consistent with the desired level of service and cost.

Step 3: Identification of the bulk and mass shipment, frequency, distinctive needs and the transit time in transportation.

Step 4: Identification of consolidation chances and weight breaks that support cost and performance requirements.

Step 5: Creation of a simple multi-functional milieu that takes into consideration all variables discussed above.

Step 6: Creating a machinery for handling exclusions that fits within the existing business procedures.

Step 7: Creating rules and regulations.

Step 8: Distribution of a routing guide.

Step 9: Creating communication processes related to the guide.

Step 10: Planning a repetition of this procedure in four months.



Weight break: It is the quantity necessary for a per unit reduction in price for the cargo's transportation.

The routing guide works as a set of effective rules which deal with sales and purchase related-freight transportation matters—for example, selection of carrier, routing, packing and labelling, claims and credit. Almost all transporters issue these arrangement guidelines after a time period of either six or twelve months.

Due to their bulky size, and drawn-out preparation time, numerous routing guides are already obsolete by the time of their distribution. In an endeavour to stay updated, some shippers distribute supplements and revised pages throughout the period of the life of the guide. As unwieldy and unfeasible as this process is for the issuers, it is equally agonizing for the receiver. Neither the purchaser nor supplier can administer changes rapidly; rather they cannot even place the changes in an effective procedure.

A routing guide should be seen as a concerted resource that enhances relations between business partners and decisions of the management, and brings down the costs for all parties, Not having good routing guides in place, costs both sellers and their consumers spend huge amount of money on an annual basis.

1.4.2 Outbound Transport

Outbound logistics denotes the procedure related to the transportation and storage of goods and how goods move from the production end to the customer end. At the outset, logistics is basically the competent organization of the flow of products comprising storage in a supply chain. To get a better understanding of the outbound transport logistics, it will be most pertinent to study the topic under the following headings.

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Warehouse Logistics: In contrast to inbound logistics which mainly focuses on buying and organizing the inbound movement of goods, parts, constituents and finished inventory from merchants to warehouses or industrial plants, outbound logistics is a completely distinct procedure. This part of logistics is based greatly on the shipment and storage of finished goods.

Basics of Outbound Logistics: Outbound logistics is not a very difficult concept. Fundamentally, it revolves around two concepts, i.e., storage and transportation.

The storage segment of logistics makes use of warehousing for the safety and easy accessibility of finished goods. As there may be a need to move merchandises to a consumer at any time, proper organization is of utmost importance. While this segment of the field mainly focusses on storage, limiting the storage to a bare minimum usually proves to be more beneficial since stored materials are not capable of making any money.

The transportation segment is by and large the most engaged and complicated part of outbound logistics. In the absence of transport, there simply can be no logistics. Consequently, it is necessary to move the goods from one place to another in the most convenient and efficient manner.

The Process of Outbound Transport: Industries or establishments pass go through various stages while being a part of the outbound logistics procedure. For example, the sales unit first gets a purchase order from the buyer. The sales unit confirms its account records to ensure that they are in a position to complete the order. After that, the order is sent to the warehouse for collecting and,packing after which the requisite product is shipped to the customer. The client is then billed and ultimately, the money in lieu of the order is collected.

Distribution Channels : Rather than working directly with the customer, most corporations take the option of using distribution channels. These distributors transport the merchandise or service to the end user. For example, a company that makes stretch film may have a number of dealers in its distribution channel. These channels handle the production, storage and transportation of these films and makes arrangement for its sale. Partly outbound logistics deals with selecting distributors who will endorse the product, have a good logistics network, and catering to all kinds of purchasers.

Optimization of Delivery: Optimization of transport and delivery is one more very significant constituent of outbound logistics. The usage of the barcode scanning system can prove to be very beneficial at the time of inventory tracking, which in turn helps to update the client about the status of the goods.

1.4.3Local and Medium Transport

A mode of transport provides the means through which finished goods and raw material are transported from one place to another. For transportation of goods to nearby places or places within the country, generally, local or medium means of transport is used. Two primary local and medium means of transport are: Road transport and rail transport. Let us have a look at the advantages and disadvantages of these means of transport in transporting people and goods from one place to another.

- Road Transport

There are many advantages of transportation of goods and people by road as compared to other means of transport:

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Advantages

1. Minimum expenditure: To ferry goods via road transport means much less capital investment is required in comparison to other methods of transport, for instance, through rail, sea or air transport. The amount of investment required in construction, operation and maintenance of roads is less than that of the railways. Roads are generally built by the administration and local authorities and only a bare minimum revenue is levied for the usage of roads.
2. 3D (Door to Door Delivery) service: The unparalleled benefit of road transport is that it delivers door-to-door or warehouse to warehouse service. This decreases cartage, plus the loading and unloading expenditure of goods.
3. Service in all parts of the country: Road transport is most suitable for transporting goods and people to and from all areas of the country, including backward and rural areas which are not connected by rail, water or air transport. Exchange of goods, between big and small towns, between cities and villages is possible only because of the availability of road transport.
4. Flexibility in service: Another great advantage road transport vis a vis other methods of transportation is the flexibility that it affords in its service, its courses and timings can be changed depending upon individual requirements and this does not cause much inconvenience to the consignor or the consignee.
5. Short distance suitability: Road transport is more economical and faster for ferrying goods and people over short distances. Delays in transportation of goods because of in-between loading and handling can be avoided. Goods can be loaded directly into a road vehicle and conveyed straight to their ultimate destination.
6. Lesser risk of damage in transit: Due to absence of intermediate loading and handling, there is lesser risk of damage, breakage of the goods being transported. Therefore, road transport is the best option possible for transporting delicate goods at a local level especially goods like chinaware and glassware, which stand a chance to get damaged while loading and unloading.
7. Cheaper packing cost: In comparison to other means of transport, the process of packing goods for road transport is far less complex, as they ought to be transported only at a local level. Goods transported by road transport need less or at times no packing in several cases.
8. Fast speed: For goods which require immediate or quick delivery, road transport proves to be more apt in comparison to railways or water transport. Water transport is very slow. Also much time is wasted in booking the goods and taking delivery of the goods in case of railway and water transport.
9. Cost-effective: Road transport not only needs a lesser amount of initial investment, rather the cost of operation and maintenance is also less in comparison to other means of transport. In cases, where the rate charged by road transport is a slightly higher than railways, the real effective cost of transporting goods by road transport is far less. That is because road transport

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saves cost in packaging of goods and the expenses of in-between loading, unloading and handling charges is also less.

10. Privately owned vehicles for transportation: One more advantage of road transport is that big business houses can have the funds to own their own road vehicles for transportation of goods, thus, they can send their products for consumption to the market as soon as they are ready, without any delay.
11. Feeder to other modes of transport: The movement of goods bay all means of transport i.e., rail, sea, air, begins and eventually ends by making use of roads. Road transport acts as a feeder to the other modes of transport.

Disadvantages

In spite of various merits, road transport has some serious limitations which are as follows:

1. Seasonal nature: Road transport is not as dependable as rail transport. During rainy season or in a flood situation, roads become unfit and unsafe for use.
2. Vulnerable nature: There are numerous chances of accidents and breakdown in the case of road transport. In addition to this, road transport is also affected by strikes or bands which do not affect other means or transport as much. Thus, motor transport is not as safe as rail transport.
3. Nor suitable for long distance and bulky traffic: This mode of transport is unsuitable and costly for transporting cheap and bulky goods over long distances.
4. Slow speed: Goods transported by road take days to reach their destination whereas other means of transport are able to ferry goods at a much faster pace.
5. Lack of organization: Road transportation lacks organization and detailing in its conduct. Many times, it is irregular and unreliable. The rates charged by different transport for the same destination may also vary to a large extent.

Rail Transport

Rail transport is a mode of carrying passengers and goods from one place to another, for instance, through rail cars, these cars move on specially made tracks. Contrary to road transport, in which vehicles move on a set flat surface, rail cars or bogeys move in one direction guided by the tracks on which they run. This kind of transport comes handy in moving goods in very large numbers or quantity, this kind of local medium of transport turns out to be cheaper to move goods domestically.

Advantages of Rail Transport

Let us go through the benefits of rail transport:

1. Reliable: The utmost advantage of rail transport is that it is the most reliable means of transport as it is just not affected by weather conditions such as rains or fog in comparison to other means of transport.
2. Well-organized: The rail transport, as a means of local and medium transport, is much better organized than any other means of transport. It has permanent routes and timetables. The service provided by it, is definitely more certain, consistent and regular as compared to other means of transport.

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3. High speed beneficial for long distances: The speed of rail transport wagons over long distances is comparatively faster than any other means of transport, except airways. Thus, it is the best choice for long distance domestic traffic.
4. Appropriate for huge and heavy merchandises: Carrying goods by rail transport turns out to be economical, faster and most suitable for carrying heavy and bulky goods over long distances.
5. Cheaper mode of transport: Rail transport is a very economical mode of transport in comparison to other modes. Most of the working overheads of railways are generally of fixed cost in nature. Each escalation in the railway traffic flow is followed by a reduction in the average price. Rail transport turns out to be cheaper in the use of labour also because one driver and one guard are enough to carry far more load than the road transport.
7. Greater capacity: The load transportation capacity of the rail wagons is tremendously huge. Furthermore, its capacity can be easily increased, by adding more wagons, or decreased, by detaching them, as per requirement.
8. Well-being of the public: Railways is the largest public undertaking in India. Many public utility services are performed by the railways. Their charges are nominal and generally founded on 'charge what the traffic can bear' belief which helps the underprivileged.

Disadvantages of Railway Transport

Although rail transport system has many advantages, it is not free from limitations. Some of them have been discussed as follows:

1. Huge capital amount: The railways need huge outlay of capital. The price of construction, upkeep and overhead expenses is too high in comparison to other means of transport. Furthermore, the investments are particular and permanent. In case of insufficient traffic, the investments may turn out to be a wastage of enormous resources.
2. Rigidity: Another disadvantage of rail transport is its rigidity. Its routes and timetables cannot be accustomed to individual needs as they are permanent.
3. Unavailability of door-to-door service: Unlike road transport, rail transport system is unable to provide door-to-door service as it is bound to a specific track. Loading or unloading of goods at unscheduled stops in-between involves huge cost, more wear and tear and wastage of time.
4. Domination: As railways need huge investment outlay, they may give rise to domination and work against public interest in general. Even though controlled and managed by the government, inefficiency and high costs may seep in because of lack of competition.
5. Unsuitable for short distance and small loads: Rail transport turns out to be unsuitable and uneconomical for short distances and small quantity of goods.
6. Booking formalities: Sending freight by rail transport takes much time and labour in booking and taking delivery of goods through railways in comparison to road transport.

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7. Unavailability of service in some parts: Due to enormous capital necessities and heavy traffic, it is not possible to operate railways economically in rural areas. As a result, many large rural areas are devoid of railway service even today. This causes much inconvenience to the people residing or doing business in rural areas.

1.4.4 Long and Continental Transportation

Several manufacturers and business operators conduct business in foreign locations. Transporting goods to such far flung places is not possible by means of road or rail transport. Hence, the best option to transport goods and people overseas is either by means of air or sea. Let us now discuss these long and continental means of transport.

Air Transport

Air transport is the latest mode of transport. It goes back to the twentieth century. The two World Wars had a strong influence on the expansion of air transport in almost all parts of the world. The distinguished quality of air transport is that is does not require any specific surface/track to operate. There are no physical barriers in air transport as is there in other means of transport. Political boundaries also do not stand in the way of air transport, though it has to observe the International rules and regulations. The utmost advantage of air transport lies in its speed. It is the fastest means of transport. Also, with the recent boom in the airways industry, flying through air has now become cheap in India. Let us now discuss some advantages and disadvantages of air transport.

Advantages of Air Transport

1. Quickness: The biggest advantage of air transport is its speed. It is the fastest means of transport and consequently, it is the most appropriate means of transportation where time is an important factor.
2. Comfortable and quick services: It provides a regular, comfortable, efficient and quick service to the modern day travellers.
3. No physical barriers: It follows the shortest and direct route as seas, mountains or forests do not come in the way of air transport.
4. Easy access: Air transport can be utilized to transport goods and people to the areas which are not easily accessible by other modes of transport.
5. Most suitable for emergency services: Air transport has the capability to operate even when all other modes of transport are not in a position to do so, perhaps due to floods, damage due to severe earthquakes or other natural calamities. Thus, during such times, air transport becomes the only means of transport which can be used for relief work to provide essential commodities to effected people.
7. Most appropriate for conveying light and high value goods: It is most suited for ferrying durable goods which require fast delivery and light goods of high value, for example, jewellery, bullion and so forth over long distances.

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Disadvantages of Air Transport

Despite many advantages of air transport, the following are its few limitations:

1. Cost ineffective: It is the most expensive means of transport as compared to the other means of transport. The fares of air transport are so high that it is beyond the reach of the common man. It is more suitable for passenger traffic movement rather than cargo conveyance.
2. Limited carrying capacity: Its carrying capacity is very limited and, therefore, it is not suited to carry cheap and voluminous merchandises.
3. Uncertain and unreliable: Air transport is uncertain and not very reliable as it is largely affected by weather conditions. Unfavourable weather, for instance, fog, snow or heavy rain may cause termination or delay in flight service.
4. Failures and accidents: The chances of breakdown and accidents are much greater in comparison to other means of transport. Therefore, it involves comparatively more risk.
5. Huge capital investment: Air transport service entails a huge amount of capital investment in the construction of airports and purchase and maintenance of airplanes. In addition, very trained and skilled individuals are required for operating air service.
6. Specialized talent and ability: Air transport service industry involves a specialized ability and high degree of training for its operation.
7. Legal restrictions: There are numerous legal restrictions enforced by several countries in the interest of their own national unity and peace.

Sea Transport

Another long and continental means of transport is the sea transport. This means of transportation involves any transportation of goods and/or passengers using maritime vessels on journeys which are undertaken completely or partially at sea. This means of transport is extremely suitable for transportation of heavy and bulky merchandise across continents. There are numerous advantages and disadvantages of sea transportation which have been discussed subsequently.

Advantages Sea Transport

Let us go through the merits of sea transport.

1. A lesser amount of maintenance cost: Maintenance cost incurred in rail and road transport is relatively high but maintenance cost of water transport is fairly less.
2. Inexpensive: Transport of freight through this channel is reasonably cheap as compared to rail and road transport.
3. Convenient for bulky goods: Heavy and bulky merchandises can be conveyed easily at comparatively much less cost through sea transport.
4. Convenient during natural calamities: During natural calamities like flood and rains, when rail and road transport is disrupted, relief operations can be operated through water transport.

5. Important means of transport for foreign trade: Sea transport plays a significantly role in successful conduct and completion of foreign trade. India's foreign trade is mostly dependent on sea/water transport.

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Disadvantages of Sea Transport

Let us go through the demerits of sea transport.

1. Sluggish speed: Transportation of goods by sea is slow in speed. It takes days or at times even months to transport goods through this means from one country to another. It is difficult to send perishable goods by sea route.
2. More risk factor involved: Transportation by sea is more risky as compared to other means because there is always danger of sinking ships or boats. Moreover, there also a constant fear of being looted by pirates of the sea.
3. Effect of weather: Sea transport as a means of carriage of merchandise is very much affected by weather and climatic conditions. It is due to these adverse climatic or weather conditions that there is always a fear of ships sinking or overturning of boats.
4. Lengthy and tedious formalities: There is tremendous paper work involved in sending shipments from one country to another. This is often time consuming and has an adverse effect on trade.

1.5 FEATURES OF LOGISTICS TRANSPORTATION

Contemporary logistics transportation works as a result of wide-ranging research in the functioning of the supply chain, its main concerns, effective risk management, varied markets, extensive collaboration and technical advances. Nevertheless, contemporary logistics is adversely affected by problems of inefficiencies, intolerable inflexibility, and failure to understand the increasing demands of customers. Some of the contemporary logistics service providers have taken steps to improve logistics entities in the future. The following are the seven key areas which form the main features of logistics in transportation.

- Practical use of detailed data: Due to technological advancements in the modern society, there is overabundance of information available on the Internet. Data has always proven to be an important characteristic of logistics transportation but it is the mindful se of necessary data that differentiates a successful logistics transportation from an unsuccessful one. Logistics transportation service providers and supply chain managers use data to identify inadequacies, create future solutions, and implement them with the help of useful data. Furthermore, the use of such data can be applied to creating verifiable predictions for needs in inventory.
- Inventory optimization: Having too much, or too little, of a given item is disadvantageous to logistics in transportation. Hence, optimization of inventory relies on accurate, precise forecasts for needed items to be conveyed from one place to another, these, however, also are largely dependent on the demand of consumers or buyers.

Check Your Progress

5. How does the feature of track & trace assist in performance management in logistics?
6. Name the two main concepts involved in outbound logistics.

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- Flexibility: With the rapid increase of economies at the global level, the number of corporate players within the logistics transportation arena has largely increased. This, however, has led to one ultimate problem: How will more orders be fulfilled in order to keep up this fast pace? Well, this is where flexibility plays an important role. Flexibility denotes the capability of logistics transportation in the supply chain to adjust to the variations within the market, political environment, and other events, which would otherwise affect trade.
- Prompt fulfillment: The extensive upsurge in connectivity, predominantly through mobile equipment, has educated customers to rely on the power of their voice and demand immediate fulfillment. Obviously, instant transport has not yet been devised, there is no doubt that whatever the means of transport may be, it will take some time, so the substitute remains guaranteeing orders are administered without error, fast, and via the fastest yet pocket friendly means of transport. Multimodal means of transport have gained a competitive advantage to giving consumers their rewards: Intricate shipping and tracking details of their products.
- Customization: Customization refers to improvising the process transportation the particular needs of the customers For instance, an order of new mobile phone may need to be completed within 24 hours and all suitable packaging may be completed right at the shipping facility. Furthermore, growth in the number of individual industries and trades within the supply chain will lead to a more varied group of products to manufacture and subsequently, repair. Thus, customization of client demand fulfillment is the utmost priority for the logistics transportation in supply chain.
- Compliance and visibility: The last, and perhaps the most important, characteristic of a best in logistics transportation is the focus on maintenance of compliance and visibility. Compliance includes adherence to any applicable local, state, and federal laws for logistics transportation entities. Nevertheless, end-to-end visibility can eradicate all of the potential issues by permitting others, especially consumers, to look into supply chain in logistics transportation.

1.6 ADVANCES IN LOGISTICS TRANSPORTATION

The transportation and logistics industry has traditionally been defined through trucks and the movement of vehicles, but over the past years technology has started to alter that definition. The usage of mobile computers, GPS tracking systems, automated tolling, and automatic vehicle logs have really transformed logistics. Other novel technologies are positioned to create just as big an impression, and the prospects of logistics are going to be striking by new developments. It is imperative for transport companies to stay abreast with these advances, even those which may be a few years away from extensive adoption.

Though there are numerous new technologies that have affected the transportation and logistics industry, let us look at some critical changes which have had a significant impact:

- Telematics and Fleet Management: Telematics, in a broad sense, is any integrated use of telecommunications with information and communications

Check Your Progress

7. How does customization assist in logistics transportation?
8. How is data used in the process of logistics transportation?

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technology. Logistics businesses have been making use of GPS systems to track their trucks for many years now. Actually what has changed is the number of novel characteristics and functions that GPS-based fleet management systems are now offering. Other than being able to see the location of the truck, managers can now set up geo fences to activate alerts when a truck is getting closer to its destination or, on the contrary, has deviated far out of its service area, enhance routes using real-time traffic data, develop vehicle employment, and automatically track driver hours and fuel tax recording information.

The telematics functions of these system also enables to keep record of vehicle maintenance needs, and sound alerts if the engine is in any kind of trouble. This helps in avoiding breakdowns and extension in the life of the vehicle being used. Lastly, with the help of this facility companies can track over speeding, sudden braking or speeding up, unnecessary idling and other conditions that will reduce fuel efficiency, save costs, and improve safety.

- The Internet of Things (IoT): The IoT comprises making use of sensors and network communications to link machines to the Internet. This enables monitoring equipment through remote control devices and receiving alerts if machines are in need of repair or service. IoT is an extension of the sorts of telematics information that has already been delivered. This can begin further upstream in the chain of ordering, engineering and warehousing. Smart machines will announce their requirements in case of new parts or consumables before they run out. With stronger demand indications, the supply chain will automatically become more responsive. The availability of affordable sensors and bluetooth cordless technology will make it simple to add trucks to this mushrooming online network of supply chain data, bringing forth visibility up to the last-mile that was earlier not attainable.
- Delivery through drones and driverless cars: Amazon's announcement that it planned to use unmanned flying drones for delivering goods to customers made a huge stir in the market. Although the thought of flying robots releasing packages from the sky sounds pretty exciting, yet practical considerations such as cost, security, procedures and so forth are likely keep delivery operations in their present situation for many more years.

  Driverless vans/lorries, instead, are a development that may affect the logistics and transportation industry in the near future. Numerous companies have already conducted detailed testing of driverless cars on the roads, and there are many test amenities in the United States where the work on development of technology is a continuous process. Several automobile manufactures have also presented semi-auto driving competences in their vehicles. Moreover, Uber's Otto division is already testing driverless trucks for logistics and delivery applications. By eradicating the requirement for a driver, logistics companies can handle the shortfall of drivers and critically improve safety by reducing the fatigue of drivers.
- Cloud-Based computing and business analytics: Frequently, people view technology as strictly related to hardware and gadgets. Nevertheless, the significant escalation in competencies and developments in construction for

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cloud-based computing and business analytics also intensely affects transportation. For a long time, telematics and RFID and other technologies have delivered a lot of usable data, but companies seldom have been in a position to capture and consolidate that data, leave alone harnessing the value of analytics. The sophistication of software and data architecture now allows all the data to be efficiently controlled and operated to produce not only detailed position of movement and procedure flow, but prognostic and suggestive guidance to proactively develop operations and curtail problems even before they take place.

The transportation and logistics business should accept these changes gradually. Doing so will increase their competitive position and make them capable of meeting the prospective requirements and demands of their buyers. The development of e-commerce undoubtedly is the biggest development in this field. Developments in the scope and acceptance of the e-commerce industry indicate that the pressures and importance of the supply chain working correctly for companies is more decisive than ever to regulate their success. With transport and logistics being central to this, making technological advancements to enhance processes is even more imperative with the way deliveries are collected, packed, tracked and conveyed.

- **Automation:** Automation, which is one of the principal technological developments, has given the logistics industry a whole new outlook. Automation of the collecting and packing process inside a warehouse helps multinational companies to deliver packages to consumers much quicker than before and helps in considerably reducing costs. With new applications being developed by transportation companies, a consumer can now see the exact location of his/her package on its journey towards its destination, it allows much less opportunity for goods to be lost in transit and places focus on efficacy being at the core of the service a company delivers to its customers.

Appreciating the past and seeing the current situation provides a rough picture to what may be in store for logistics in the times to come. The trend towards greater than before globalization, unrestricted trade, and subcontracting all contribute to a continued and growing interest in logistics.

According to a McKinsey & Company study,'...by the year 2020, 80 per cent of the goods in the world will be manufactured in a country different from where they are consumed compared with 20 per cent now.' There will be a tremendous change in the transportation and consumption of merchandises, and all this will need ever better management of the related supply chain procedures. There is bound to be a major change in the strategies of the present times.

In the past, the focus of logistics or supply chain management used to be on efficiency. As Peter Drucker (Drucker, 1962) put it, physical distribution has been 'the last frontier of cost economies'. There is no doubt that the concept of logistics and supply chain management will continue to grow as long as companies continue to outsource, broadening their transnational operations, and conducting exchanges in a global economic environment. Whatever may be the name given to the field managing product flows, which is today called supply chain management, the trend has been set

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and there is no looking back now. There are, however, some major challenges which are likely to come in the way of effective logistics in the near future.

An income generation policy for the supply chain will be as imperative as the one dealing with cost reduction. There will be more number of attempts to see supply chain strategies as a means of generating income for the firm quite in the same way, it views product mix, advertising and price as elements of its marketing strategy. Planning the logistics processes that result in a level of logistics customer service is the basis for a supply chain strategy, since logistics customer service is related to revenue.

Sharing of information among members of the channel is expected to carry on with advancement in technology and this may be termed as coordination, compromise and cooperation. Enhancements in number, value, and distribution of information throughout the supply chain are key reasons for considering spanning the boundary of management. Many times information sharing is seen as channel partner partnership and substitutes for true compromise. Supply chain management or logistics is more complex than exchanging data between companies and among the various functional areas within a firm. In several cases, the channel partners need to compromise their positions on the matter of supply chain decisions, which is the most difficult aspect of logistics. Future research should be concentrated on helping managers deal particularly with supply chain management or issues of logistics to reach to a compromise.

Once the benefits of supply chain cooperation are recognized, actions need to be taken to share the benefits and keep the mergers operating in a manner to remain producing these benefits. Some methods, both formal and informal, have been previously seen; however, it is still unclear as to which is most effective and under what circumstances. Research will help to clarify the best choices and how they may be put into practice.

Supply chain relationships are not characteristically to be found in a steady state, so instances of good supply chain organization among a few firms will be selective and short-termed. The reason being that coalitions are brittle and the associates may simply return to the state of their own interest at the time when trust is broken, information is inadequate or erroneous, and the sharing of benefits is observed to be or is truly unfair, there are likely to be hardly any examples of real supply chain collaboration spanning many heights in the channel. Thus, we can think of only a few examples, where widespread channel collaboration may have occurred. There will be only few chosen examples among a pair of channel partners, which is most probably to be between a firm and its direct supplier. Bearing in mind the trouble of keeping relationships together, the lack of a good boundary-spanning accounting system with appropriate metrics, and with little managerial training in supply chain relationship building, it will be a long time before the assurances of logistics see the light of day.

Logistics programmes transforming into a supply chain programme should be extended to comprise the subjects of relationship and trust building. On an academic level, imparting knowledge about supply chain management will need supplementary topics which are at present not included in a typical logistics curriculum. Boundary-spanning management relies on association building, relationship, cooperation, and organization across separate firms, but these proportions have not traditionally been a fundamental part of logistics teaching.

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The concept of operations, buying, selling and logistics will structurally merge perhaps under the banner of supply chain. The wide-ranging scope of supply chain management will have an effect on the functioning of organizations. Whereas logistics may have a limited scope, supply chain management entails organization across numerous functions inside the industry. In order to accomplish coordination, it may be compulsory for firms to reorganize themselves. Buying and manufacturing have often been equated with marketing and finance, but in the time to come, these functions, as well as logistics, will be kept under the supervision of the supply chain manager. Firms desirous of achieving good coordination of product flows, may opt for a less official arrangement, such as a supply chain link placed at the top of the organization who has charge for organizing supply chain actions across the various functions within the firm. To coordinate among supply chain channel members, committees constituted of channel members will appear since formal organizational assemblies across legally separate firms are not probable to happen.

1.7 SUMMARY

Some of the important concepts discussed in this unit are:

- Transportation and logistics is all about comparing the details of travel, and the complex dynamics behind moving people or goods from place A to place B.
- As per the APICS dictionary, logistics has been defined in two ways: a) In an industrial setting— the art and science of obtaining, producing and distributing material and product in the proper place and in proper quantities. b) In a military way (where it has greater usage), its meaning can also include the movement of personnel.
- Logistics needs planning, whereas, transportation is just the means to implement the plan, while transporting merchandise from place A to place B. Undoubtedly, they are not the same thing, but to put it simply, transportation is a part of logistics.
- With the commencement of liberalization globalization and privatization in the present century, the prominence of logistics management has increased in different areas.
- Transportation is one of the more essential activities in the conduct of a business. By moving goods from places where they are manufactured to places where they are in demand, transportation gives the necessary provision of joining an enterprise to its contractors and clients.
- The role of transportation in logistics is more complicated than simply transporting goods. Its complexity can be handled only through highly quality management. By means of a well-handled transport system, goods can be easily sent to the right place at the right time in order to satisfy customers' demands.
- There are many benefits of the Transportation Management System (TMS) recognized by the industrialists, distributors and businessmen. A transportation management system facilitates businesses to move consignments from the origin to the destination quickly, efficiently and economically.

Check Your Progress

9. Define telematics.
10. Mention the significant impact of the Internet of Things (IoT) in the transportation and logistics industry.

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- A well-designed and well-planned transport system could include enormous and well-organized networks like airports, sea ports, railway stations and bus stops.
- Preparation of a routing guide is the first step towards developing healthy inbound transport mechanism. A routing guide outlines the guidelines of arrangement between the manufacturers and consumers.
- Outbound logistics denotes the procedure related to the transportation and storage of goods and how goods move from the production end to the customer end. At the outset, logistics is basically the competent organization of the flow of products comprising storage in a supply chain.
- Outbound logistics is not a very difficult concept. Fundamentally, it revolves around two concepts, i.e., storage and transportation.
- A mode of transport provides the means through which finished goods and raw material are transported from one place to another. For transportation of goods to nearby places or places within the country, generally, local or medium means of transport is used.
- Several manufacturers and business operators conduct business in foreign locations. Transporting goods to such far flung places is not possible by means of road or rail transport.
- Contemporary logistics transportation works as a result of wide-ranging research in the functioning of the supply chain, its main concerns, effective risk management, varied markets, extensive collaboration and technical advances.
- The transportation and logistics industry has traditionally been defined through trucks and the movement of vehicles, but over the past years technology has started to alter that definition. The usage of mobile computers, GPS tracking systems, automated tolling, and automatic vehicle logs have really transformed logistics.
- The transportation and logistics business should accept these changes gradually. Doing so will increase their competitive position and make them capable of meeting the prospective requirements and demands of their buyers.

1.8 ANSWERS TO CHECK YOUR PROGRESS

1. The various important concepts that are covered under transportation in logistics are as follows:
    - Packaging
    - Containerization
    - Documentation
    - Insurance
    - Storage
    - Importing and exporting regulations
    - Freight damage claims
    - Working and collaborating with other executives within the supply chain
    - Managing vendors and partners

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2. Logistics needs planning, whereas, transportation is just the means to implement the plan, while transporting merchandise from place A to place B.
3. A transportation management system (TMS) facilitates businesses to move consignments from the origin to the destination quickly, efficiently and economically. TMS includes solutions for moving merchandise by all means and also includes multimodal/intermodal movement of freight.
4. Common carriers are those which offer transportation services to the general public at affordable prices. They are not authorized to refuse to carry a specific article of trade or refuse to deliver goods to a particular point within the ambit of its operation.
5. This feature of track & trace in a TMS, permits real-time exchange of shipment information between the carrier, consignor and consignee. Carrier companies have their internal software equipped to track the movement of shipment during the transit period. Through this method of track and trace, the carrier monitors the movement of the shipment till its final delivery to the consignee.
6. Outbound logistics revolves around two concepts, i.e., storage and transportation.
7. Customization refers to improvising the process transportation the particular needs of the customers For instance, an order of new mobile phone may need to be completed within 24 hours and all suitable packaging may be completed right at the shipping facility.
8. Logistics transportation service providers and supply chain managers use data to identify inadequacies, create future solutions, and implement them with the help of useful data. Furthermore, the use of such data can be applied to creating verifiable predictions for needs in inventory.
9. Telematics, in a broad sense, is any integrated use of telecommunications with information and communications technology.
10. The IoT comprises making use of sensors and network communications to link machines to the Internet. This enables monitoring equipment through remote control devices and receiving alerts if machines are in need of repair or service. IoT is an extension of the sorts of telematics information that has already been delivered. This can begin further upstream in the chain of ordering, engineering and warehousing.

1.9 QUESTIONS AND EXERCISES

Short-Answer Questions

1. Define logistics.
2. List the various benefits of the Transportation Management System (TMS).
3. What is long and continental transportation?
4. Write a short note on the two primary local and medium means of transport.

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Long-Answer Questions

1. Analyse the significance of transportation in logistics.
2. 'The role of transportation in logistics is more complicated than simply transporting goods.' Explain the statement.
3. Differentiate between inbound and outbound logistics.
4. Discuss the features of logistics transportation.
5. Discuss the various new technologies that have had a significant impact in the field of logistics transportation.

UNIT 2 RAILWAYS AND LOGISTICS CONTOURS

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Structure

2.0 INTRODUCTION

Rail transportation is the most significant means of transportation across the world. A country's railway system not only transports people, goods, emergency services but also army paraphernalia.

Railways came into being around 6 BC. The earliest railway track constructed was 6 km long and it was used for the transportation of water vessels or boats. Nevertheless, invention of the steam engine by James Watt in 1775 proved to be the turning point for railways and the use of this technology in railways. Since that time, railways have experienced massive changes across the world. Today, we have metro rails running at the speed of approximately 300 kmph. Metro rail is an electrified railway system. A metro rail system must have a distinct path; it comprises of cars. Metro moves at a much higher speed and it its pace of picking up speed is also much faster. Metro rail wagons can move on the ground level, underground or on overhead lines.

Rail transport system in any country carries a large amount of traffic, provides high speed, security, punctuality, environmental protection and energy conservation. This means of transportation is afforded by and is available to almost every average citizen of a country. India, for example, has a very sturdy and widespread railway system which is spread to even very remote parts of the country. Travel by train is considered as the most viable option of travel by a normal Indian citizen because of the easy accessibility of railway service even in rural areas.

China has built the highest rail road in the entire world, situated in the Tibetan region. The railway system present today is more reliable, durable, and advanced, which makes train journey even more economical and efficient.

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Modern Railway History Milestones

Following is the list of a few milestones in the history of railways:

- James Watt invented the Steam Engine in 1775.
- Oliver Evans developed American steam engine in 1800 and in 1804 he successfully installed it in a boat.
- The Mumbles Train ran as world's first passenger train in 1807
- First eight-wheeled engine South Carolina was built in 1831.
- President Abraham Lincoln signed the Pacific Railway Act in 1862.
- The first diesel-electric locomotive came into picture in 1918.
- High speed rail came into existence in early 1960s.
- Shanghai Metro System became the world's largest urban transit system in 2010.

In this unit, you will study about the features and facilities offered by railways, factors influencing growth of rail logistics, suitability of railways for different cargo and distance range segments, innovative schemes/facilities launched by the Railways Ministry to popularize rail logistics in India, railway infrastructure in India and freight movement and the share of railways in cargo movement in India and worldwide.

2.1 UNIT OBJECTIVES

After going through this unit, you will be able to:

- Discuss the features and facilities offered by railways
- Summarize the factors influencing growth of rail logistics
- Identify the suitability of railways for different cargo and distance range segments
- List the innovative schemes/facilities launched by the Railways Ministry to popularize rail logistics in India
- Describe railway infrastructure in India and freight movement
- Assess the share of railways in cargo movement in India and worldwide

2.2 FEATURES AND FACILITIES OFFERED BY RAILWAYS

Let us begin our discussion with the basic characteristics of rail transportation.

1. **Railway Tracks:** A railway track principally includes two steel rails that run parallel to each other and are fixed perpendicularly to the components which are called railway sleepers, these sleepers are made of wood, steel, or concrete and their aim is to keep a continual distance between the tracks, the track guides the wheels of the railway cars in the wanted direction without the driver having to put in much piloting effort. The tracks grant the trains to be considerably longer as compared to any road transport vehicle. The rails and sleepers are positioned on flattened earth foundations. It is made sure that the load of rail

tracks and sleepers is evenly disseminated on the ground so that track buckling can be avoided. Vibration control is crucial to ensure the stability of the trains, rails, and the rail foundations. There are numerous ways to release stress in the welded sections. The rails are subject to wide-ranging pressures and strains because of which the materials used in construction must be of good quality alloy steel, and the rails must have expansion joints for changes in temperature. The more the weight of the rails and other components, the faster the trains can run.

2. **Track components:** The railway track is a multifaceted arrangement of rails, sleepers, and clasps fitted on hard bases. This complex arrangement is like other assemblies that are firmly fixed to the ground. Rail track may be supposed to be suspended on the ground foundation. Thus, the study and examination of track stresses is difficult and important for ensuring safety of the track. The outward rail is higher compared to the inner side rail on the curves. This practice is called super elevation, and it reduces the forces that are likely to disrupt the track. This process makes the train ride a comfortable distance. The track is designed to withstand the stationary and dynamic wheel loads and disperse them to the ground. The components of the railway track are exposed to diverse loads because the train moves on the rails. These stresses are determined by treating the track as a flexible structure.
3. **Continuous welded rail:** Continuous welded rail, as utilized in contemporary railway systems, is also known as ribbon rail. In this type of track, flash butt welding is used to join rails with one another. Flash butt welding needs an automated track positioning apparatus with a strong electric current. The colour of the ends turns white hot due to the electrical resistance, and then they are linked to one another generating a strong weld. The continuous welded rail sections are mended by thermite welding. Since there are few joints, this track is tremendously durable, does not require too much maintenance and it provides a smooth ride. This enables trains to reach high speeds with very less friction. Laying of welded rails is costly in comparison to the linked tracks. If not managed skilfully, the rails may extend during hot weather and contract during cold weather. The rail movement connected to the sleeper is organized by using anchors or clips. Anchors are usually used for wood sleepers, whereas clips are used to secure concrete and steel sleepers. If the longitudinal and lateral rail panels are insufficient, the track will alter its pattern with variations in temperature, thus, causing derailment.

Modifications in technology and escalations in passenger movement have resulted in the abandonment of thousands of miles of railway tracks in the United States. Some of the railway tracks have been elevated and those which could not be elevated have been rendered out of use by the government and railway companies due to security reasons.

Prominent Features of Rail Transportation

Railways since inception have been playing a very significant role in the economic, social and political growth of most countries around the world. Although the railway needs a vast capital amount in comparison to other means of transportation, yet it is

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Super elevation: It is the amount by which the outer edge of a curve on a road or railway is banked above the inner edge.

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the main means of transport used by people far and wide. It carries about 70 to 80 per cent of overall traffic of merchandises and people. The Indian Railways is the largest railway system in Asia and the fourth biggest in the world. Besides this, it is also the biggest public enterprise in the country. The prominent features of Indian Railways are as follows:

1. **Public convenience service:** Railways deliver a vital service to the general masses. Being a public utility service, it needs to be defended and funded by the government.
2. **Domination:** Railways enjoy monopoly in India. The rail transport is controlled by the Railways Department, under the aegis of the central government. Unlike air transportation, no private operator has been granted permission to enter this transport sector.
3. **Enormous investments:** The railways entail hefty investments for procurement of land, laying down tracks, construction of railway stations and sheds, purchasing automobiles and so forth. It is not possible for any one entity to make all these investments; hence, this undertaking is maintained by the governing authorities of the country.
4. **Privileges:** In order to deliver an effective transport service, the railways need some special privileges. Railways need special property rights for acquisition of land, building bridges and railway lines.
5. **Special rate fixation:** There is a provision in railways to fix separate rate for passenger and merchandise traffic. Same rates are valid for all people and in all parts of the country. Rail services are accessible to all members or the public on the same terms.
6. **Non-transferability:** After the railway lines have been laid down, these tracks cannot be used for any other purpose. So it can be said that railway services are non- transferable because of the money time and effort involved in setting up the system.
7. **Suitability:** There is no doubt that rail transport system is not free of limitations, yet it can be safely said that it plays a very important part in the economic, social and political development of a state. Transportation by rail is chiefly suitable in the following scenarios:
   - Carrying heavy and bulky goods
   - Carrying cheap goods
   - Carrying passengers and goods over long distances

Facilities Provided by Rail Transport

After going through the preceding section, it becomes absolutely clear that rail transport is one of the most convenient and affordable kind of transportation provided to the citizens of a nation. Rail transportation not only proves beneficial for people as it is cheap and easily available but it is also the best means of transporting bulky and heavy goods. Let us now have a look at the various kinds of facilities that are provided by the Indian rail transport service.

Passenger Facilities

Facilities provided to passengers travelling by train are divided into three heads:

- Minimum Essential Facilities
- Recommended Facilities
- Desirable Facilities

Additional Desirable Facilities

1. Minimum essential facilities: The following are the minimum essential facilities that ought to be provided according to the category of station to passengers travelling by train at all stations, these include:
   - o Booking facilities
   - o Platforms
   - o Shelters/Shady trees
   - o Drinking water arrangements
   - o Waiting hall/shed
   - o Seating arrangements
   - o Train Time table
   - o Lighting
2. Recommended facilities: Minimum essential facilities may not be commensurate with the actual passenger traffic .Therefore, norms for increasing the facilities are provided as per the laid down scale, based on the category of the station and the number of passengers dealt with at any time during peak hours including.
3. Desirable facilities: Desirable facilities are provided to increase customer satisfaction and the interface, these facilities include:
   - o Catering & vending stalls
   - o Adequate parking and circulating area
   - o Train indication board
   - o Public address system

   Desirable facilities are provided based on the need and relative importance of the station.

   Additional Desirable Facilities: A1 Stations of the country ought to provide train travellers some additional desirable facilities which are as follows:
   - o Cyber Café
   - o Food Plaza
   - o At least one VIP lounge
   - o Train coach indication system
   - o CCTV for announcement and security purpose
   - o Coin operated ticket vending machine
   - o Static mobile charging facility
   - o Facelift of station building including facade

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Flash butt welding: It is one of the resistance welding processes, in which the energy transfer to the parts that are going to be joined is mainly provided by resistance heat in the parts themselves.

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Adarsh Railway Stations Scheme

The Government of India is on a drive to improve the existing facilities to rail passengers of the country. It has initiated improvements in the following fields according to the category of the station.

A1, A & B category Stations:

- Improvement in the façade of the station building,
- Circulating area so as to ensure proper entry and exit of vehicles
- A lighting tower for proper illumination
- Improved modern, cost effective lighting arrangements at the platforms, concourse and others
- Renovated water booths
- Renovated, modern, Pay & Use toilets
- Good Waiting and Retiring Rooms with modern furniture
- Good passenger guidance system including signage and coach indication boards
- Improvement of booking and enquiry offices to give them a facelift
- Lighting of booking office, the queuing area in front of booking windows
- Engagement of reputed architects/consultants for beautification

C Category Stations

- Ethnic-ethos - local art/architecture reflected in a distinctive and colourful manner
- Quick entry and exit for passengers
- Smooth access from civil road to station premises
- Provision of signage i.e. location of ladies/handicapped coach
- Provision of green toilets in local trains
- Minimum 4 urinals/2 toilets at the platform
- Renovated / made by Railways operated on 'Pay and Use' basis
- Ease of drainage and sanitation
- Full shelters on the platforms for better protection from elements

Freight Facilities

The following freight facilities are offered to transporters of freight through railways. Railways make transportation of cargo a simple and easy process:

- **Devoted rakes:** Devoted and tailor made rakes designed for carrying specific goods allow well-organized movement of bulky cargo among terminals, hubs and warehouses, based on fixed assurance volumes. This facility is beneficial to large industrial plants/groups functioning in manufacturing sectors such as iron and steel, cement, metals, alloys and others.
- **Selection of schedule:** Consumers have the flexibility to select their own freight schedule as per their business condition and need.
- **Fixed schedule facilities:** A point-to-point 'fixed' plan provided by rail freight service proves beneficial for clients conveying light loads, who are in need of

predictable departure. Linking main metro cities, the facility operates on a fixed departure and arrival schedule.

- **Integrated infrastructure and connectivity**: Railway department's Free Trade Warehousing Zones and the Inland Container Depots are connected with almost all parts of the country. They also have access to the major gateway ports by means of their integrated rail freight network and unified supply chain solutions, which provide all-India reach.
- **Customized containers:** Customers moving freight can order for containers suiting their requirement, this facility allows consumers to enjoy smooth operations, which leads to higher competence, lesser expenditures and faster despatch and return time.
- **Cargo tracking:** Transparent tracking of cargo throughout the various stages of movement ensures constant updates for timely decisions.

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2.3 FACTORS INFLUENCING GROWTH OF RAIL LOGISTICS

Indian Scenario

The Indian Railway system provides the main means of transport to the various parts of the country. Railways practically constitute the lifeline of the nation, supplying to its needs for widespread movement of traffic, both freight and passenger, thus, contributing to economic growth and promotion of national integration. In reality, railways establish the mainstay of surface transport system in the country.



Transhipment: It is a term used for shipment of goods to an intermediate destination before being shipped to its final destination.

The first railway line in India was made available for public use on 16 April 1853 between Mumbai and Thane which covered a distance of 34 km. This line was stretched to Kalyan on 1 May 1854 and to Khopoli on 12 May 1856. The Khandala-Pune segment was made available to public on 14 June 1858. At the time when railway lines were being constructed in eastern part of India and the first segment of the East Indian Railway, between Haora and Hugli, covering a distance of 37 km was started on 15 August 1854.

The railway line from Kanpur to Allahabad was made available in 1859 and the Haora-Khana-Rajmahal segment was finished in 1860. Mughal Sarai also came into existence on the railway map of the country in 1862. In 1860, the Kanpur-Etawah segment was initiated for public use and between 1862 and 1866 all the gaps between Howrah and Delhi were covered by the rail network.

The southern part of India did not trail behind and got its first railway line from Royapuram to Arcot in 1856, which was 105 km in length. This line was stretched to Kadalundi in 1861. The Jolar Pettai-Bangalore Cantonment segment was made available in 1864. In 1870, the all-rail route between Kolkata and Mumbai began to function and the chief line from Mughal Sarai to Lahore (now in Pakistan) was successfully completed. The Mumbai-Chennai route was started in 1871. In consequence within a short period of 18 years from, mostly all important cities of India were linked to each other by rail.

Check Your Progress

1. List any two prominent features of rail transportation.
2. Mention the kinds of facilities provided to passengers travelling by train.

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Today, the Indian Railway Network is the second largest railway network of Asia and the fourth biggest in the world. First in the list is USA (2, 27,736 km), followed by Russia (2, 22,293 km), and then China (87,157 km). Indian Railways is the biggest public sector undertaking of the nation encompassing an enormous network of 6,906 stations spread over a route length of 63,122 km with a fleet of 7,681 engines, 39,852 passenger service vehicles, 4,904 other coaching vehicles and 2,14,760 wagons as on 31 March 2003. The growth of Indian Railways has been phenomenal indeed.

Of the entire freight, over 85 per cent includes coal, ores, food grains, cement and petroleum. A massive strength of 15 lakh permanent and 2.5 lakh short-term employees are continuously active in organizing and sustaining the railways, making it the largest employer of workforce in the country.

The Indian railways are constantly operative, day or night. To think of India without the railways invokes the depressing image of a nation that is stationary and immovable.

Factors affecting Railways and its Growth

The configuration of the Indian railway network is influenced by three factors namely, geographical, financial and political and administrative factors.

1. **Geographical factors:** The plains of North India with their level land, high density of population and rich agriculture present the most positive conditions for the expansion of railways. Nevertheless, the existence of large number of rivers makes it compulsory to build bridges which require substantial expenditure. The flood plains of various rivers situated in Bihar and Assam comprise of almost zero railway lines. The highland areas of South India have also been found not very suitable for railways just like the Northern Plains. The high mountain ranges of the Himalayan region in the north are almost completely without any railway lines due to the prevalent rocky and steep terrain.

   Likewise, the sandy stretches of Rajasthan are also not very favourable for laying down railway lines.

   The first railway line between Jodhpur and Jaisalmer in Rajasthan was laid down as late as 1966. Likewise, forest regions of Madhya Pradesh and Orissa, delta marshes of West Bengal, swampy regions of Rann of Kachchh and mountainous zone of Sahyadri are also not very favourable for the expansion of railways.
2. **Financial factors:** Better development of railways takes place in economically progressive areas where the need for railways is more. On the other hand, the development of railways brings economic success to the areas where they are established. This is because the economic connections find the maximum density of railways close to big cities and industrial centres and in regions which are rich in mineral deposits and agricultural land.
3. **Political and administrative factors:** The current railway system in our country is the legacy of the colonial rule in India. The direction and pattern of the railway lines was planned by the British administration in such a way that they could make maximum use of the treasured raw materials of India in order to benefit

their industries and to use Indian as markets for the finished merchandises from Britain.

In addition, the British wanted to preserve their armed sovereignty, for which rapid movement of troops and weapons was needed. Hence, building of railway lines across the country became unavoidable. Therefore, chief significance was given to the big ports of Mumbai, Kolkata and Chennai. These ports were linked with their neighbourhoods by railway lines to expedite imports and exports. It is from the ports that the railway network spread to the other parts of the country.

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Growth in Rail Logistics

Along with the quantifiable development, Indian railways have a striking record of qualitative growth in the field of rail logistics. Following are the key zones of qualitative development through the recent years which have facilitated rail users in many ways.

1. **Gauge conversion:** 'Gauge' is actually the distance between the inner faces of the pair of rails forming the track. Indian railways include three kinds of gauges namely, broad gauge (1.675 metre), metre gauge (1.000 metre), and narrow gauge (0.762 metre and 0.610 metre). The British constructed broad gauge railways on trunk ways linking the port cities of Mumbai, Kolkata and Chennai and some other main cities. In areas which lay beyond the frame work of trunk routes, only metre gauge lines were built.



Gauge: It is actually the distance between the inner faces of the pair of rails forming the track.

2. **Engine and wagon conversion:** Between 1950 and 1960 maximum number of trains were run by steam engines and coal was used as the source of energy. These engines did not possess very high power of traction and the smoke emitted by them even caused environmental pollution. Hence, there was an urgent need to substitute these engines by diesel and electric engines which had more power and their operation was not so expensive.

   Furthermore, it was seen that diesel engines caused less ecological pollution in comparison to coal locomotives, and electric engines caused no pollution at all. That is the reason that the steam engines were phased out and are not functional anymore, so much so that their production has also been stopped in India.

   Railway coaches and wagons have also been upgraded to in order to make the transportation of passengers and merchandises more convenient and economical. Padded seats, toilets and pantry cars are provided in almost all the main trains carrying passengers. Such facilities did not exist earlier. Till the start of the 20th century, no one cared much for passengers travelling by third class, though they formed 97 per cent of the travelling traffic. Provision of second class travel has been made instead of third class travel has now and also, A.C. 3-Tier coach has been initiated to make AC travel cheaper and convenient.

3. **Electrification of the track:** As stated before, use of electric engines enhances the passenger capacity by almost 100 per cent. But electric engines can be used only if there is a provision of electrification of railway tracks. Electrification of tracks is a main thrust area by which efficiency of the railways can be increase manifold.

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Electrification of the track was introduced in the beginning 1920s and the first two segments from Victoria Terminus to Kurla and from Victoria Terminus to Bandra, total of 16 route km were electrified in 1925. Therefore, the Indian railways entered the push button era. In the first four decades from1920–21 to 1960–61, the process of track electrification was somewhat slow and the length of electrified track stood at 388 km in 1950–51 and 748 km in 1960–61.Though electrification of tracks is an expensive bid, yet it is unavoidable keeping in mind the increasing number of passengers and pressure of freight movement on the railways.

4. **Other improvements:** Automatic signals have been introduced on the main routes. For heavy traffic track structure has been reinforced by providing heavy and strong rails and concrete sleepers. For quick and convenient journey, numerous new trains have been introduced, for example, Rajdhani and Shatabdi. Public facilities at the railway stations have been expanded and upgraded.

2.3 SUITABILITY FOR DIFFERENT CARGO AND DISTANCE RANGE SEGMENTS

Rail freight transport means making use of railroads and trains for movement of cargo in contrast to people as passengers. A freight/goods train is a collection of freight carriages or goods wagons towed by one or more engines on a railway track, transporting freight, all or part of the way between the transporter and the journey's proposed end, as part of the logistics chain. Trains might tow bulk material, intermodal vessels, common or specific freight in specially designed wagons. Every country and region has different rail freight practices and finances.

While taking into consideration tonne/kilometre towed per unit consumption of energy, rail transport can be additionally efficient in comparison to other modes of transportation. Most economies are characteristically shaped with bulk commodities, for example, coal, particularly when towed over long distances. Nevertheless, carrying freight by rail is not as flexible as by road, which is the reason why much freight is generally carried by trucks on road, even for very long distances. Moving goods by rail often contains transhipment expenses, mainly when the transporter or recipient lacks direct rail access. These outlays may exceed that of operating the train itself, a factor that practices such as containerization aim to minimize.

Conventionally, large haulers construct plants and warehouses close to railway lines and have a segment of track on their land which is known by the name of siding, where merchandises are loaded on or unloaded from rail wagons. Other transporters have their merchandises towed by wagon or truck to or from a goods station. Smaller engines transfer the rail wagons from the sidings and goods stations to the arrangement yard, where each wagon is linked up with one of many long distance trains being put together, based on the destination of the wagon. When a train attains a desirable length based on a timetable, it is then dispatched to another sorting yard. At the next yard, wagons are sorted again.

The ones which are intended to move to stations served by that particular yard are allocated to local trains for the purpose of delivery. The leftover wagons are assembled all over again into trains heading towards sorting yards situated close to

Check Your Progress

3. When was the first railway line in India made open for public use?
4. When was the electrification of railway track introduced in India?

their ultimate destination. A standalone wagon may be classified again or swapped in many yards before it reaches its final destination. This procedure has made carriage of rail freight slow and expensive. Many cargo rail operators are endeavouring to lessen these charges by decreasing or excluding swapping in sorting yards through procedures, for example, unit trains and containerization. In many nations, railroads have been built to tow one product, such as coal or ore, from an inland point to a port.

Rail freight carriers use many kinds of goods or freight wagons. Box cars or covered wagons, flat wagons, well wagons or 'low loader' wagons, refrigerator wagons, simple types of open-topped wagons and others are some examples of carrier wagons. Selection of wagon actually depends upon the nature of merchandise being transported and also the distance that ought to be covered until its final destination.

The success of railroads is largely dependent on the network, the more number of points of contact in the network attach greater value to the system as a whole. Initially, railroads were constructed to transport essential resources, for example, coal, ores and agricultural products from inland places to ports for exporting them outside the country. Better connectivity unlocks the rail network to additional freight uses including traffic not related to export. Rail network connectivity has its limitations based on a number of factors, comprising physical barriers, for example, oceans and mountains, technical unsuitability, predominantly diverse track metres and political clashes. The biggest rail networks are situated in North America and Eurasia. Long distance freight trains are usually longer than passenger trains, they have better length refining efficiency.

Usually in most big economies, freight is moved through trucks on roads. Several countries are trying to increase speed and volume of rail freight in an effort to triumph over markets or to relieve traffic on road and/or accelerate shipping. In Japan, trends towards adding rail freight shipping are more due to availability of workers rather than other concerns.

Many nations in the European Union have developed a standard-gauge network. The United Kingdom is connected to this network through the Channel Tunnel. The 'Marmaray' project links Europe with eastern Turkey, Iran, and the Middle East through a rail tunnel beneath the Bosphorus strait. Spain and Portugal railways are generally broad gauge; however, Spain has constructed some standard gauge lines that link with the European high-speed passenger network. The countries of the erstwhile Soviet Union, together with Finland and Mongolia, have joined the Russian gauge compatible network, using SA3 couplers. China has a widespread standard-gauge network. Its cargo trains make use of Janney couplers. China's railways link with the standard-gauge network of North Korea in the east, with the Russian-gauge network of Russia, Mongolia, and Kazakhstan in the north, and with the meter-gauge network of Vietnam in the south.

Suitability of transporting through freight train in India (to neighbouring countries)

Freight train for automobile transportation in India and Pakistan function completely on broad gauge networks. Indo-Pakistani combats and skirmishes presently limit rail traffic between both countries to two passenger lines. There are also connects from India to Bangladesh and Nepal, and from Pakistan to Iran, where a new, but less utilized, connection to the standard-gauge network is existing at Zahedan. The four

main Eurasian networks have connected the neighbouring countries. Containerization has facilitated greater movement between networks, including a Eurasian Land Bridge.

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2.4 INNOVATIVE SCHEMES/FACILITIES TO POPULARIZE RAIL LOGISTICS IN INDIA

The Railway Ministry of India has proposed a host of new schemes recently in order to give a boost to the existing passenger rail network in the country. In an effort to fulfil the community responsibilities towards differently-abled, senior citizens and women commuters, the railways have introduced a number of schemes. Some of these new schemes announced in the passenger sector are as follows:

- 100 rail stations to get Wi-Fi this year
- Indian Railways will provide 17,000 bio-toilets on trains
- E-catering services to be extended to 408 stations
- Developing Delhi-Chennai, Kharagpur-Mumbai and Kharagpur-Vijayawada freight corridors on a priority basis
- To create rail auto hub in Chennai
- Watchdog proposed for railways
- FM radio entertainment on trains
- With new uniforms, railway porter will be called Sahayaks
- Half of lower berths reserved for senior citizens
- Baby food at stations, child menu on all trains
- Local cuisine to be available on trains
- Ticket cancellation through phone calls
- To install 1,780 automatic ticketing machines
- CCTV surveillance in all stations in a phased manner
- Local art to be highlighted at railway stations
- Dedicated freight corridors envisaged for North-South, East-West and East Coast alignments

New Initiatives of Indian Railways in Freight Sector

The Railway Ministry of India has launched two schemes in the freight sector which are as follows:

1. **Special Freight Operator Scheme (SFTO):** SFTO offers savings for procurement of high capacity and special purpose rail carriages for particular merchandises for instance molasses, fly ash, edible oil, caustic soda, chemical, petrochemicals, alumina and bulk cement.
2. **Automobile Freight Train Operator Scheme (AFTO)**: AFTO offers attaining and operation of specific purpose carriages for movement of vehicles, i.e., two /three -wheelers, cars and tractors.

Check Your Progress

5. Give some examples of carrier wagons.
6. What is the use of the freight/goods train?

With a view to interacting with the customers for freight booking, 'Key Customer Managers' have been nominated for each commodity and to establish liaison with major customers/stakeholders and Zonal Railways.

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Consequences of new initiatives taken by railways are as follows:

- Under SFTO, 3 rakes have been obtained and are even running on the railways network since November 2015.
- Under AFTO, 9 rakes of BCACBM carriages have been acquired and are running on Indian Railways.
- Increasing the axle load for carrying additional traffic per wagon. Length of freight trains has also been augmented to transport more traffic per train.
- Use of widespread mechanization in freight operations to increase checking and to improve use of assets.
- Positioning of higher capacity engines and higher capacity coaches.
- Betterment in preservation practices of carriages and engines consequential in increased obtainability of engines, wagons and so forth for traffic use.
- Enhancement in track and signalling to carry the high capacity of traffic.
- Freight rates for coal transportation have been rationalized.
- Rationalization of Merry-Go-Round (MGR) system w.e.f. 01.04.2016.
- Withdrawal of Port Congestion Charge from 13.04.2016.
- Extension of Automatic Freight Rebate scheme for traffic loaded in traditional empty flow direction w.e.f. 13.04.2016.
- Withdrawal of Busy Season Charge for traffic loaded in BCN group and BCNHL wagons w.e.f. 01.05.2016 till 30.06.2016.
- Withdrawal of dual freight policy for iron ore w.e.f. 10.05.2016.
- Re-introduction of short lead concession and reduction of minimum distance for charge from 125 km to 100 km w.e.f. 15.07.2016.
- BCN group permitted for two point booking and mini rake w.e.f. 15.03.2016.
- Distance for mini rake increased from 400 km to 600 km w.e.f. 15.03.2016.
- A liberalised policy with delegation of power to Zonal Railways introduced for two point booking of covered wagons in which any two stations within a distance of 200km in busy season and 400km in lean season have been permitted for two point booking w.e.f. 22.07.2016.
- Proliferation of Roll-on Roll-off (RORO) service on Indian Railways.
- Permission to notify Group I and Group II station/ goods sheds as CRTs for lift on-lift off operations w.e.f. 12.07.2016.
- Charging of commodities for transportation by containers has been liberalized. 43 additional commodities de-notified for charging at FAK rates.
- Guidelines for Station to Station Rate policy issued.

Indian Railways Freight and Passenger Business Action Plan -2017–18

Following key freight sector initiatives have also been initiated by the Railway Ministry of India:

- Policy of 'Long Term Contracts' with major customers.
- Indian Railways Freight and Passenger Business Action Plan 2017–18.

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- Confirmation trial of Double stack Dwarf Container Train under wire— a New Delivery Model.
- The demonstration run of Ro-Ro (Roll on–Roll off) service across the National Capital Region.

Over the years, the share of railways in our country's total traffic has lessened considerably. Railways earn its two-third profits from freight only. Keeping in view the global slowdown, the transportation sector has also not registered positive growth. However, in spite of all challenges, Indian Railways has fared well to progress its earning from freight. During the last couple of years, the Railways Ministry has been repetitively altering its cargo policies and streamlining them in discussion with all stakeholders with an aim to draw more freight in the direction of railways. For these variations, Indian Railways has assumed a market-oriented methodology to formulate traffic policies. These breakthrough reforms in cargo policy are in accordance with the declarations of the budget.

With the improvement in cargo loading, everybody will benefit, be it railways, or consumer or the entire ecosystem. Indian Railways is working in line with the broader development agenda of the central government. The concept of Double Stack Dwarf Container train is also a worthy thought as it will not only save time but also turn out to be economical. Likewise, the notion of RO-RO services is also very advantageous from the point of view of pollution, public health and for speedy transport.

Salient Features of Key Freight Sector Initiatives

1. **Roll-On Roll-Off (RO-RO):** The Ministry of Railways announced that an Action Plan will be established and implemented to expand the freight carriage either through containerization or novel delivery models. Roll-on-Roll-off is such a novel delivery model which can provide multimodal transportation. RO-RO services were started on the Konkan Railway and then proliferated to ECR and NFR fruitfully last year.

   The model project for Green Transport across NCR is the next such provision being introduced on Indian Railways in the near future. As per a study, conducted by the Centre for Science and Environment, commercial trucks and lorries arriving in Delhi emit around 30 per cent of the total particle load and 22 per cent of Nitrogen oxide load. This kind of a project would significantly decrease the pollution in the air throughout the NCR region, which is the reason for serious health ailments. RO-RO services can offer a choice to these heavy and light commercial vehicles to take a detour around the capital city of Delhi.

2. **Long-Term Tariff Contracts/Agreements:** In agreement with the declaration made by the Railways Ministry in the Railway Budget 2016–17, a decision has been taken to launch the policy of Long-Term Tariff Agreements/ Contracts with railway's main freight customers by means of pre-determined price appreciation norm.

   Objectives of the Policy

   - Long-term Gross Freight Revenue (corresponding to Minimum Guaranteed Quantity) commitments from customers at pre-determined price escalation principle.

o Grant of incremental Gross Freight Revenue (GFR) linked and absolute GFR (corresponding to gross volumes) linked discount to customers

The Key Features of the Policy

- Minimum Guaranteed Volume linked discounts on the basis of incremental growth in Gross Freight Revenue in return for commitment to provide Minimum Guaranteed Quantity of traffic.
  - Discounts range from 1.5 per cent to 35 per cent as per the incremental growth in GFR.
  - Customers are required to offer at least one million tonne traffic per annum.
  - Minimum period of agreement shall not be less than three years and at stretch not more than 5 years.
  - New customer will have to offer more than 3 million tonne traffic during the agreement period and one million traffic in the first year itself.
- In case of customers already offering more than 5 million tonnes of traffic discount would be granted on the basis of absolute GFR corresponding to the total volume of traffic offered by the company during the previous 12 months subject to the same GFR being maintained over the period of the agreement.
  - The discounts range from 0.5 per cent to 5 per cent according to the volume of traffic.
  - The customers already offering more than five million tonne of traffic can avail both discounts also subject to fulfilment of conditions.

o Excluded commodities: All commodities below Class-100, Coal & Coke, Military traffic and RMC.

o Under the pre-determined price escalation principle, any increase or decrease in freight rates will be implemented from the beginning of the next year of the agreement only.

o Discount in freight under this scheme will be given as refund within 45 days.

o Agreement will be signed at Zonal Railway level.

o In case of multi zone operations of a customer, the agreement will be signed with that Zonal Railway which deals with maximum traffic of that customer.

o Customer can opt for single zone or multi zone agreements or both.

Advantages of the Policy

o Stability and certainty of long-term tariff/freight rates to the customers

o Assured supply of wagons/rakes to the customers through preferential traffic order (PTO).

o Incremental guaranteed volume of traffic and GFR to railways.

3. **Trials Of Double Stack Dwarf Containers:** As per the announcements made in the Railway Budget 2016–17, the Railway Ministry has proclaimed that a plan of action will be implemented and applied to magnify the freight ambit and recapture the traffic either through containerization or novel delivery models.

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Key characteristics of Double Stack Dwarf Container Train are as follows:

- o Double Stack Dwarf Container Trains are designed to have a height of 6 feet 4 inches to run under wire for greatest throughput with increased ability to load.
- o The above electric gear in electrified territories on the Indian Railways acts as an intrusion to rise and spread of ISO double stack containers (with conventional height of 8.5 ft. and 9.5 ft.) on electrified section. All important routes are electrified.
- o A single stack ISO 40 feet container has a load ability of around 32 tonnes which can be augmented to around 54 tonnes in Double Stack Dwarf Containers on electrified sections. Hence, the load-ability per BLC wagon can be increased by more than 55 per cent by using this delivery model.
- o In a BLC rake, 90 TEUs of conventional containers can be transported under wire while through dwarf containers, 180 TEUs can be transported in a BLC rake.
- o The concept has been received with excitement by various groups of customers transporting commodities with low- weight- volume ratio.
- o A preliminary trial run of Double Stack Dwarf Containers was undertaken in January 2017. After ensuring removal of infrastructure constraints, a confirmatory trial run was launched on 2nd March 2017 by the Minister of Railways between Ambala and Jamnagar (with run from Ambala to Ludhiana under wire) after which commercial runs will be started.

Advantages of Double Stack Dwarf Container Train are as follows:

- o The load-ability per BLC wagon under wire would increase by more than 55% thereby increasing throughput.
- o Per unit cost of transportation would come down. Beneficial to commodities with low weight- volume ratio.
- o The model envisages procurement of BLC rakes and development of Dwarf Containers by Container Train Operators and other stakeholders.
- o Indian Railways is likely to regain lost modal share and capture new traffic in domestic segment like Petchem products such as low density/high density polyethylene, plastic granules, white goods, PVC and Polyester fabric and so forth.
- o Likely to attract additional traffic of around 3 million tonnes in the initial year.

- **Indian Railway's Business Plan 2017–18**

Key Characteristics of the Business Plan 2017–18 are as follows:

Freight Segment

- o Upgrading the Delivery System by initiatives like revamp of railway goods sheds through partnerships with stakeholders (Pilot for 10 goods sheds followed by policy for scaling up), New Delivery Models like Ro-Ro, Dwarf Containers (Being launched today), Road-Railers (Between Palwal and Melpakkam), new terminals (100 by end of 2017–18) .
- o Better freight services and rationalized tariffs to expand the freight basket(more commodities like Bulk Cement, Steel Products and so forth to

be taken out of restricted list for Containerization, long term contracts with freight customers, end-to-end solutions (through partnerships at 10 goods sheds), rationalization of weighment policy, Timetabled trains with premium on assured transit time (50 paths to be carved out in 2017–18) and procurement of specialized rolling stock for sectors like automobiles.

o Operational strategies to enhance throughput like procurement of 3000 25T BOXNS wagons in 2017-18, leverage IT and to improve asset utilization.

o International freight services under which a demo train run between Bangladesh and India and a meeting of CEOs of railways of concerned countries to boost intermodal regional connectivity is planned in 2017–18

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Passenger Segment

o Transformation of ticketing by migrating towards cashless, paperless ticketing (6000 PoS machines and 1000 Ticket Vending Machines in 2017–18), Aadhaar -based ticketing and an integrated ticketing Application by May 2017.

o Providing comfort and a pleasurable journey experience through induction of new LHB Rakes(about 2300 coaches in 2017–18), adding comfort features to coaches, improvement in catering and converting 25 stations to DigiPay mode in 2017–18 by digitizing the entire station transactions.

o Fulfilling travel needs by scaling up the new train products like Humsafar (7 new services by 2017), Antyodaya (7 new services by June 2017), Tejas (3 new services by June 2017) and others, meeting demand surges through adequate special trains and coaches, a new policy for rail tourism including development of Hill Railways through partnerships besides several new Tourist Friendly Packages.

2.5 RAILWAY INFRASTRUCTURE IN INDIA AND FREIGHT MOVEMENT

Indian Railways is one of the biggest network systems in the world. It is also one of the uncommon railway systems which is generating functional surpluses. From its modest inception in April 1853, to the contemporary times, the Indian Railways has today developed as the main means of transport contributing to the socio-economic development of the nation. Rail transportation has many positive features as compared to transportation by means of road or air. The social benefit of having the railway network is that there is minimal environmental damage caused by the movement of railways across the country. Construction of railway infrastructure costs approximately six times lower than road construction for comparable levels of traffic. It is the only major transport mode capable of using any form of primary energy. Let us now look at a few important points concerning railways infrastructure:

1. **Contributing to contemporary market economy:** From the very beginning, the Indian Railways, has worked towards integration of the fragmented markets and, thus, inspiring the rise of a modern market economy. It links the centres of industrial production with markets and also with sources of raw materials and above this enables industrial development and also establishes links between

Check Your Progress

7. State the main feature of the Special Freight Operator Scheme (SFTO).
8. Mention two key features of Double Stack Dwarf Container Train.

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the centres of agricultural production with far off markets. The railways offer a dependable and lucrative option of transporting coal from the coal fields to power plants and petrol products from refinery plants to the consumption centres. It connects places, allowing extensive, speedy and economic movement of people throughout the country. In the progression, the Indian Railways has come to represent national integration and has become a strategic instrument for improving our defence mechanism.

The Indian Railways has significantly contributed to the economic development of our country. It accounts for six per cent of the entire employment in the organized sector directly and an extra 2.5 per cent indirectly through the organizations dependent on it. It has made huge amount of investments in the field of health, education, housing and sanitation. With its enormous network of schools and training institutes, the Indian Railways plays a significant role in human resource development.

There has been an impressive growth in the freight and passenger traffic being carried by the Indian Railways after independence. While the input indices in terms of route (kilometre), engines, passenger trains and coach capacity have doubled, the traffic output indices have increased six times after independence. These accomplishments have been a result of selective inputs of affordable technology, implementation of innovative operational strategies, reduction of staff members and operating costs and rigorous monitoring of movement and maintenance areas.

2. **Corporate Strategy:** The railways has been taking constant efforts to increase its freight and passenger business by developing pricing mechanisms to enhance its customer base. It has introduced steps to improve market share in the bulk freight business as well as to maintain growth in the non-bulk business. Suitable growth strategies for each passenger segment have also been developed to secure regaining several costs for the passenger business in totality through internal cross-subsidization within the various passenger segments.



Fiber-optic telecommunication: It is a method of transmitting information from one place to another by sending pulses of light through an optical fibre.

The Indian Railways has been taking constant efforts to strengthen its high density network to make the system capable of meeting the expected demands of the freight and passenger business. It attempts to decrease functional costs by enhancing efficiency of the manufacturing units; by improving the purchasing procedures not only to secure cost reduction but also to improve dependability; by reducing manpower in a reasonable manner. Indian Railways is trying to discover the likelihood of inviting investment in fibre-optic telecommunication network and commercial exploitation of air space above stations. Other steps include manipulating the leasing route for obtaining the rolling stock, innovative financing techniques and 'Sell and Lease Back' mechanisms to leverage the existing fixed as well as mobile assets.

3. **Modern Technology:** The Railways plans to utilize modern technology in numerous spheres of its functionality. It aims at a tough track structure with heavy and metallurgical better quality rails, higher output energy, classic electric and diesel engines, light and comfortable passenger trains of modular construction with high speed bogies and lighter wagons with improved bogies with higher speeds and better payload. Other measures involved are solid state inter-locking,

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block proving with axle counters, centralized electronic interlocking, universal emergency communication in the areas of safety signs and signals, optic fibre and digital microwave in the area of communication, dual voltage three-phase drive Electric Multiple Units for suburban services and Diesel Multiple Units (DMUs) and Main Line Electric Multiple Units (MEMUs) for mass intra-urban and suburban traffic. The Indian Railways also plans to realize the probability of IT usage in all capacities of railway management and operations to economize costs and improve efficacy and security.

4. **Infrastructure:** The Indian Railways has a magnificent past and has attained a remarkable progress in both freight and passenger transportation by refining asset utilization and efficacy of processes and procedures. The time has come when huge investments are needed for intensifying the rail infrastructure and providing the railways its due share in the infrastructure development of the country.

   The discussions and talks concerning the improvement of transportation in the country have not focused on the railway sector in a wholesome manner. It is high time that the role of railways as the main infrastructure service provider is reinforced. Constructive backing from the government and the active and market-oriented response to the difficulties of an open economy will set the tone for a new era of the Indian Railways as we move forward in time.

   The Indian Railways is confronting the most difficult challenge in the current times. The railways is completely a government owned venture. The railways has two foremost segments to look into —the passenger segment and the freight segment. 23 million passengers in 1,261 passenger trains, travel by Indian Railways every day. The Indian Railways network comprises 7,112 railway stations. Thus, Indian Railways is one among the world's biggest networks comprising of 115,000 track km over a route of 67,312 km. The total earning of railways has been 16,379 crore from all segments of traffic, but only 44,283 crore from the passenger traffic between 2015 and 2016. The railways has fixed its target to earning 55,000 crore from the passenger segment— an upsurge of additional 15 per cent in comparison to the previous year. The percentage of passenger traffic on the railways is tremendously high, predominantly for passengers travelling long distances.

   On the freight segment, the railways earned 109,207 crore in 2015–16. It has set a target of earning 117,933 crore in the year 2016–17, i.e., an increase of about 8 per cent. Nevertheless, the growth in freight traffic in the year gone by has been only 2.23 per cent. In the financial year 2015–16, the railways transported 1,104 million tonnes of freight traffic in comparison to 1,097 million tonnes in the year 2014–15. The target for the year 2016–17 has been fixed at 1,160 million tonnes, which reflects a target of 5 per cent growth. The real freight loading in the existing financial year (up to September) has been 6.25 per cent less than the target and 1.6 per cent less than the corresponding period of last year. The main deficit in loading has been in coal, raw material, steel plants, cement, food grains, fertilizers and other goods. In the container sector also, there has been a deficit in comparison to the set target, however, the loading in comparison to last year has been marginally higher. It would be essential to

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understand the above facts to realize in what direction the Indian Railways is heading.

The state of affairs does not appear to be very bright as the freight segment which has earnings of about 65 per cent of the total revenues of the railways does not seem to be developing at a pace which should be more advanced than the growth rate of the Indian economy which is growing at 7.5 per cent. Hence, the railways rather than growing at about 10 to 12 per cent every year has, in fact, grown by only 4 to 5 per cent in the transportation of freight traffic.

2.5 SHARE OF RAILWAYS IN CARGO MOVEMENT IN INDIA AND WORLDWIDE

Railway systems across the world have been successful in linking people and places that would otherwise have not been easy to reach. Over time, the technology used in transportation has advanced from steam engines to diesel-electric to high-speed electric ones. Railways have always been the important constituent of expansion and growth of a country; they have contributed in the formation of the modern society. A stable and well-developed railway network is an indicator of economic well-being of a country.

Cargo Traffic in India



Cargo: It refers to goods carried by a large vehicle, like a plane, ship, train, or truck.

The share of railways in the transport sector has declined. The main contender of railways is the roadways. The share of the Indian Railways in freight transport across the country has gradually reduced from 65 per cent to just 30 per cent at present. The traffic of cement, petroleum products, iron and steel and other commodities, together with containers has been moving away from railways to the roadways because of the impractical rating system followed by the railways in spite of being well aware that an irregular increase in pricing is guaranteed to result in deviation of freight traffic from rail to road. It has been stated by the railways that it is accruing heavy losses in the movement of passenger traffic, particularly in short distances and the suburban traffic. Consequently, it has been forced to escalate the freight charges on the goods traffic without increasing the passenger fares which are subsidized. Even so, the railways is bearing a loss of more than 20,000 crore a year in passenger traffic and it is not in a position to escalate the passenger fares due to political compulsions.

The vision of the Indian Railways, therefore, should be to undoubtedly set up a course where it can revolutionize and be monetarily practical with augmented efficacy and also by decreasing the overheads expenditure. The railways understood that unjustifiable increase in the cost for the transport of freight traffic has proven to be detrimental and has only resulted in deviation of freight and short distance passenger traffic to road. The Indian government has taken time to understand that railways is a part of the indispensable infrastructure of the country which requires to be enhanced to meet the challenges of passenger as well as freight traffic by making the much needed investment into capacity enhancement works. To fulfil that prerequisite, the railways has come up with the Dedicated Freight Corridors from Kolkata to Punjab (Ludhiana) for movement of bulk traffic like coal and steel from NCR (National Capital Region) to Mumbai for the movement of container traffic to the ports of JNPT, Mundra and Pipavav. The railways took a decision to invest in increasing the capacity of the

Check Your Progress

9. Mention the use of modern technology in the Indian Railways.
10. How much has been the earnings from railways in 2015–16?

present tracks which are used for passenger and freight transportation. The Railway Board and Zonal Railways are seriously endeavouring towards executing the report of the Committee for Mobilisation of Resources for Major Railway Projects and restructuring of the Railway Ministry. The road to recovery is long and the current requirement is to work hard to keep the Indian Railways moving to meet the present and future challenges by becoming a viable and efficient mode of transport.

Cargo Traffic in the World

Cargo trains carry goods ranging from bulk materials to shipping containers (used for ships, trains, and trucks) and, sometimes, have particular freight carriages for specific material as well. Cargo trains are often a desired method of transportation to attain maximum economic efficiency of the product being transported. Freight trains are used to move bulk commodities (like coal, minerals and agricultural products) from the interior parts of a country to the seaside ports. Some countries have particularly high railway cargo traffic. Let us study the freight traffic of some major countries in the world.

US Railway Cargo Traffic

The US moves 2.525 trillion tonne-kilometres on an annual basis. The railway industry offers over 220,000 jobs throughout the US. Of the entire rail cargo, around 91 per cent constitutes agriculture and energy products, vehicles and parts, construction materials, coal, chemicals, food, metal, minerals, and paper. These merchandises are known as bulk commodities. Consumer goods make up the remaining 9 per cent. Goods are mainly moved from rural areas, manufacturing centres, and coastal ports to urban areas and factory locations. The railways link Canada and Mexico at several gateways.

China Railway Cargo Traffic

China has the second most dense cargo traffic in the world. It moves 2.518 trillion tonne-kilometres every year. The prime usage of railways in China is to transport bulk cargo, specifically coal. This natural resource contributes roughly 58 per cent of total products transported via train; an additional 20 per cent consists of ore and minerals. Residual cargo comprises grains and fertilizers. Almost all of the products carried by trains are for domestic use.

Russian Railway Cargo Traffic

The third dense cargo traffic in the world is carried out in Russia. It transports 2.222 trillion tonne-kilometres annually. This freight runs over much greater distances than that of China or the US; this is because Russia's expanse is greater than both countries. Quite like the first two railway systems, coal is the main commodity being transported in Russia. After coal, metal constitutes the second major cargo to be transported.

The top three nations on the list of freight transportation in the world, together move over 1 trillion tonne-kilometres each year, making it a tremendously high figure. Balance of the countries move in the billion tonne range, which is also a striking number. These places (and their cargo sizes) are India (625.7 billion), Canada (352.5 billion), Brazil (267.7 billion), Ukraine (237.7 billion), Kazakhstan (235.8 billion), South Africa

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(113.3 billion), and Germany (104.3 billion). Even though the most of the cargo sent across these lines is quite alike and comprises merchandises like those sent in the top three countries, every country does have its distinctive differences. In India, for instance, the cost of transportation by railway is relatively higher, and the rail lines need to be improved. In Canada, cargo can be transported at the cost of just a few cents; per tonne per kilometre.

Effect of freight transportation by rail on the country's economy

Freight railroad systems provide significant contribution to the economic progress of the nation. Actually, no other means of transport or industry has brought about as much change within a country as the railways. It has made the transportation of enormous quantities of food products, raw goods, and building materials over long distances possible in short duration. The ease of using freight transportation by rail has not only allowed markets to grow within these countries as well as promoted the development of these respective countries as well.

2.8 SUMMARY

Some of the important concepts discussed in this unit are:

- Rail transportation is the most significant means of transportation across the world. A country's railway system not only transports people, goods, emergency services, and army paraphernalia.
- Rail transport system in any country carries a large amount of traffic, provides high speed, security, punctuality, environmental protection and energy conservation.
- China has built the highest rail road in the entire world, situated in the Tibetan region. The railway system present today is more reliable, durable, and advanced, which makes train journey even more economical and efficient.
- The railway track is a multifaceted arrangement of rails, sleepers, and clasps fitted on hard bases. This complex arrangement is like other assemblies that are firmly fixed to the ground.
- Modifications in technology and escalations in passenger movement have resulted in the abandonment of thousands of miles of railway tracks in the United States.
- Railways since inception have been playing a very significant role in the economic, social and political growth of most countries around the world. Although the railway needs a vast capital amount in comparison to other means of transportation, yet it is the main means of transport used by people far and wide.
- The Government of India is on a drive to improve the existing facilities to rail passengers of the country.
- Transparent tracking of cargo throughout the various stages of movement ensures constant updates for timely decisions.
- The first railway line in India was made available for public use on 16 April 1853 between Mumbai and Thane which covered a distance of 34 km. This line was stretched to Kalyan on 1 May 1854 and to Khopoli on 12 May 1856.

Check Your Progress

11. Why has the share of Indian Railways in freight transport across the country declined?
12. Name the three countries which top the list of transporting maximum freight via railways.

- The configuration of the Indian railway network is influenced by three factors namely, geographical, financial and political and administrative factors.
- 'Gauge' is actually the distance between the inner faces of the pair of rails forming the track. Indian railways include three kinds of gauges namely, broad gauge (1.675 metre), metre gauge (1.000 metre), and narrow gauge (0.762 metre and 0.610 metre).
- Railway coaches and wagons have also been upgraded to in order to make the transportation of passengers and merchandises more convenient and economical.
- Electrification of the track was introduced in thc beginning 1920s and the first two segments from Victoria Terminus to Kurla and from Victoria Terminus to Bandra, total of 16 route km were electrified in 1925.
- A freight/goods train is a collection of freight carriages or goods wagons towed by one or more engines on a railway track, transporting freight, all or part of the way between the transporter and the journey's proposed end, as part of the logistics chain.
- Rail freight carriers use many kinds of goods or freight wagons. Box cars or covered wagons, flat wagons, well wagons or 'low loader' wagons, refrigerator wagons, simple types of open-topped wagons and others are some examples of carrier wagons.
- Usually in most big economies, freight is moved through trucks on roads. Several countries are trying to increase speed and volume of rail freight in an effort to triumph over markets or to relieve traffic on road and/or accelerate shipping.
- Many nations in the European Union have developed a standard-gauge network. The United Kingdom is connected to this network through the Channel Tunnel. The 'Marmaray' project links Europe with eastern Turkey, Iran, and the Middle East through a rail tunnel beneath the Bosphorus strait.
- The Railway Ministry of India has proposed a host of new schemes recently in order to give a boost to the existing passenger rail network in the country. In an effort to fulfil the community responsibilities towards differently-abled, senior citizens and women commuters, the railways have introduced a number of schemes.
- The Ministry of Railways announced that an Action Plan will be established and implemented to expand the freight carriage either through containerization or novel delivery models.
- As per the announcements made in the Railway Budget 2016–17, the Railway Ministry has proclaimed that a plan of action will be implemented and applied to magnify the freight ambit and recapture the traffic either through containerization or novel delivery models.
- From its modest inception in April 1853, to the contemporary times, the Indian Railways has today developed as the main means of transport contributing to the socio-economic development of the nation.
- The Indian Railways has significantly contributed to the economic development of our country. It accounts for six per cent of the entire employment in the organized sector directly and an extra 2.5 per cent indirectly through the organizations dependent on it.

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- The Indian Railways has a magnificent past and has attained a remarkable progress in both freight and passenger transportation by refining asset utilization and efficacy of processes and procedures.
- The Indian Railways is one among the world's biggest networks comprising of 115,000 track km over a route of 67,312 km. The total earning of railways has been 16,379 crore from all segments of traffic, but only 44,283 crore from the passenger traffic between 2015 and 2016.
- Railway systems across the world have been successful in linking people and places that would otherwise have not been easy to reach. Over time, the technology used in transportation has advanced from steam engines to diesel-electric to high-speed electric ones.
- The share of railways in the transport sector has declined. The main contender of railways is the roadways. The share of the Indian Railways in freight transport across the country has gradually reduced from 65 per cent to just 30 per cent at present.
- Cargo trains carry goods ranging from bulk materials to shipping containers (used for ships, trains, and trucks) and, sometimes, have particular freight carriages for specific material as well. Cargo trains are often a desired method of transportation to attain maximum economic efficiency of the product being transported.
- Freight railroad systems provide significant contribution to the economic progress of the nation. Actually, no other means of transport or industry has brought about as much change within a country as the railways.

2.9 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Two prominent features of rail transportation are as follows:
    - Public convenience service: Railways deliver a vital service to the general masses. Being a public utility service, it needs to be defended and funded by the government.
    - Domination: Railways enjoy monopoly in India. The rail transport is controlled by the Railways Department, under the aegis of the central government. Unlike air transportation, no private operator has been granted permission to enter this transport sector.
2. The kinds of facilities provided to passengers travelling by train are as follows:
    - Minimum Essential Facilities
    - Recommended Facilities
    - Desirable Facilities
3. The first railway line in India was made available for public use on 16 April 1853 between Mumbai and Thane which covered a distance of 34 km.
4. The electrification of the railway track was introduced in India in the beginning of 1920s.

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5. Box cars or covered wagons, flat wagons, well wagons or 'low loader' wagons, refrigerator wagons, simple types of open-topped wagons and others are some examples of carrier wagons.
6. A freight/goods train is used for transporting freight, all or part of the way between the transporter and the journey's proposed end, as part of the logistics chain.
7. SFTO offers savings for procurement of high capacity and special purpose rail carriages for particular merchandises for instance molasses, fly ash, edible oil, caustic soda, chemical, petrochemicals, alumina and bulk cement.
8. Two key features of Double Stack Dwarf Container Train are as follows:
   - Double Stack Dwarf Container Trains are designed to have a height of 6 feet 4 inches to run under wire for greatest throughput with increased ability to load.
   - In a BLC rake, 90 TEUs of conventional containers can be transported under wire while through dwarf containers, 180 TEUs can be transported in a BLC rake.
9. The Railways plans to utilize modern technology in numerous spheres of its functionality. Modern technology has been utilized in providing solid state interlocking, block proving with axle counters, centralized electronic interlocking, universal emergency communication in the areas of safety signs and signals, optic fibre and digital microwave in the area of communication, dual voltage three-phase drive Electric Multiple Units for suburban services and Diesel Multiple Units (DMUs) and Main Line Electric Multiple Units (MEMUs) for mass intra-urban and suburban traffic.
10. The total earning of railways has been 16,379 crore from all segments of traffic, but only 44,283 crore from the passenger traffic between 2015 and 2016.
11. The share of Indian Railways in freight transport across the country has declined because of the impractical rating system followed by the railways in spite of being well aware that an irregular increase in pricing is guaranteed to result in deviation of freight traffic from rail to road.
12. USA, China and Russia top the list of transporting maximum freight via railways.

2.10 QUESTIONS AND EXERCISES

Short-Answer Questions

1. What are the facilities provided by rail transport to passengers?
2. Write a short note on the factors influencing the growth of rail logistics.
3. Briefly mention the innovative schemes/facilities launched by the Railway Ministry to popularize rail logistics in India.
4. Prepare a short note on the share of railways in cargo movement in India and worldwide.

Long-Answer Questions

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1. Discuss the main characteristics of rail transportation.
2. 'Railways make transportation of cargo a simple and easy process.' Explain the statement.
3. Analyse the suitability of railways for transportation of different cargo.
4. 'Many nations in the European Union have developed a standard-gauge network.' Give examples to support this statement.
5. Discuss the various aspects of railway infrastructure in India.

UNIT 3 RAILWAYS AND LOGISTICS ECONOMICS

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Structure

3.0 INTRODUCTION

In order to carry on providing services to individuals and industries and to continue being economically solvent, Indian Railways must have adequate income to bear the cost of management, upkeep of its assets, processes. The freight determination policy has, thus, an important role to play with respect to the financial health of the railways. While keeping this in mind, the railways cannot be heedless of their part as a leading public service provider and the effect that their freight determination policy will have an effect on the rail consumer and the overall financial growth of the country. This unit will discuss the general principles for assessing railway freight policy and describe the various benefits of cargo consolidation. This unit will also deal with the concept of route scheduling.

3.1 UNIT OBJECTIVES

After going through this unit, you will be able to

- List the advantages of rail sidings
- Identify the challenges related to wagon pooling
- Discuss the general principles for assessing railway freight policy
- Explain freight elasticity in domestic and international level
- Describe the various benefits of cargo consolidation
- Explain how the advancement in technology have helped railways

3.2 FREIGHT DETERMINATION FOR CARGO IN RAILWAYS

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The Railway Freight Determination Policy was postulated in the agreements of the private Railway Companies contracted at the time of constitution of railway lines in India from 1853 that rates and fares will have to be determined with the sanction of the government (at that time the East India Company) who may order their reduction only in the event of remaining profits of the railway exceeding 10 per cent of the capital expenditure. Other than this condition, there was no guideline issued by the government related to railway rates and fares in the initial period.

Most freight rates were fixed in 1868, and the businesses were left free to fix the rates within these ceilings. There was no fixation of a minimum rate. Besides coal and food grains, five classes were approved for goods, but there was no specification as to the classification under which each product was to be kept. Separate rates were decided for coal and food grains. In 1880, after completion of the shorter railway route between Delhi and Bombay, inter-railway competition came into existence, which led to a reduction in rates. In March 1883, government pronounced the general principle for fixing rates and fares which means that rates would fluctuate between the maximum of what the commuter traffic could tolerate and the minimum fixed by cost of carriage. In 1887, government fixed definite minimum and maximum rates for five classes and one special class, based on approximate and ready obtainable statistical data.

In 1905, a universal grouping of goods related to overall railways, conditional to certain exclusions, was developed by the Traffic Simplification Committee set up by the I. R. C. A. and this grouping was reported in the tariff of July, 1910. Permission of the Railway Board was made obligatory for any alterations in the grouping of goods or to the grouping of any extra commodity. Nevertheless, fixation of rates by companies on an independent basis and free of each other carried on without any changes within the least and the maximum confines laid down for every class. Special freight rates carried on being quoted without restrictions by individual railways to get hold of traffic for their own railway lines.

The need for adjusting freight rates, or estimating different rates and to help industries grow in India was emphasized upon by the Indian Fiscal Commission in 1922. One of the steps taken in this respect was that from April 1, 1922, the number of classes was increased to 10. After 1923, the new economic policy of discriminatory protection to local industries was adopted and the need for distinctive freight rates for new industries was stressed.

Further, effort at the alteration of railway freight rates structure was made with the introduction of a reviewed classification from May, 1936. Six more classes were included amongst the then existing 10 classes, allowing broader possibility for re-grouping. Nevertheless, some of the integral flaws in the distinctive system of railways were not touched.

With the incorporation of the railway systems about 1948, it was the right time to evolve a standard freight rate structure. The rail freight arrangement was revised in October, 1948 presenting the telescopic principle and removing numerous 'station-

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to-station' rates as well as the system of charging inflated distances. Besides telescopic class rates, wagon-load scales were also initiated in place of diverse scheduled rates existing 31 various railways. This was a big step towards development of a rationalised freight structure which was intended to assist the interest of the country as one. Nevertheless, soon there was seen a demand to introduce concessional and liberal station-to-station freight rates in the Reports of the Indian Fiscal Committee, 1950 and the Taxation Enquiry Committee (1953-54).

The Railway Freight Structure Enquiry Committee was established in June, 1955 by the Ministry of Railways to appraise the then prevailing railway freight structure and to recommend, among other things, changes keeping in mind the requirements of the developing nation and the requirement for preserving the economic stability of the railways.

The main recommendations of the Committee were as follows:

- Fundamental reconsideration of the design of the legs of the telescopic freight structure
- Setting a wagon-load grouping and a 'smalls' grouping for all merchandises
- Elimination of station charges by taking these into thought in developing the revised freight structure
- Discontinuance of the distinct tax of transhipment /ghat charges
- Development of a percentage system of freight rates from the lowest class to the highest class to form a collective scale of rates to cover both class rates and wagon-load rates

Keeping in view the recommendations of this Committee, a revised freight structure was initiated in 1958. With passing time, changes were seen in the freight organization with an idea to raise surplus proceeds for bearing the escalation in expenses. Likewise, changes were also made in the passenger tariffs and parcel structures. The Public Accounts Committee along with the Railway Convention Committee had scrutinized the tariffs and had stressed upon the need for streamlining the fare and freight structure with due consideration to cost of service. Consequently, a high powered Committee, namely, Rail Tariff Enquiry Committee was put together in 1977. This committee gave its report in the year 1980. The prevailing Goods/Passenger and Parcels freight structures, more or less are based on the recommendations of this Committee.

Traffic Assessment an Essential Factor in Determining Freight Cost

A general statement had been made by the Freight Structure Enquiry Committee (1955-57) that it was time for the Indian Railways to make an unrelenting effort to determine, to the farthest limit possible, the direct cast of service, and pay attention of this in defining the suitable rates for individual merchandises. Detailed attention has been given by the railways to determine traffic costing over the past years so that it can be used as an effective support to organization, primarily in the matter of changes in freight structure and for the purpose of financial assessment of projects. Costing of rail transport cannot strictly be compared to the costing of merchandises of other services. Rail transport offers many distinctive features which are missing in the case of other merchandises and products. Let us take the example of transport services which are offered at hundreds of stations all over the nation and decisions have to be taken

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on a pan-India basis whereas other means of transportation, including road operations, function only in a limited range with the singular objective of making maximum profits. There are numerous services created by the Railways for example goods transport of various commodities, carrying passengers of different classes, luggage, parcels, etc. In addition to this, transportation is a 'consumable' commodity, which means that it cannot be stored. If the wagons have remained unutilized for loading, they remain idle and the transport capacity during that period is lost eternally. Likewise, if there are no passengers on some seats on a passenger train, the related earning capacity for those particular seats is lost eternally. Another uniqueness of rail processes is that it is extremely capital intensive and its assets have to be fashioned for a long period of time may be, 40 to 60 years. There is also the difficulty of giving suitable work force seeing the inconsistent demands for rail transport depending on requirements as per season.

While efforts must be made to attain the price of service for various operations as precisely as possible, it should be understood that there are no set principles for costing. Analysis of transport prices is a complicated problem since railways are principally an industry dependent on joint cost. For instance, establishment and upkeep of railway track, wages of station staff, upkeep of railway signals and installation of telecommunication are all joint expenditures. Wherever possible, obviously, the expenditures are deducted directly and in totality to coaching service, or merchandise services, but in the case of combined costs, an appropriate basis has to be developed for distribution and also for further distribution to the sub-divisions concerned in each service, e.g., marshalling, transhipment, etc., for goods and services. Initiation of traffic costing on Indian Railways was done in the former part of 1960s with the establishment of traffic costing cell in the Board's office. Cells like this came up later in the zonal railways around 1972-73.

General Principles for Assessing Railway Freight Policy

Indian Railways transport a mixed variety of goods; resources, end products, consumables, goods in wholesale and in bags, fluids, objects of high as well as low value, delicate and hazardous goods, construction goods, medicines, chemicals and drugs, cloth (raw and finished), footwear and vital food products, and so on. To fix the freight charges for conveyance of these diverse cargoes, over long as well as short distances and under changing conditions, is plainly a very complex matter and cannot clearly be brought down to a fixated scheme. There are, nevertheless, numerous comprehensive principles which not only regulate the method of fixing the charges levied, but also the overall rate levels for different commodities, an understanding of which is essential for the study of the goods rates structure of the railways. Let us have a look at some of these principles:

- **What the traffic will bear:** One such principle is normally referred to as charging 'what the traffic will bear', which means, fixing the freight tariff for respective variety of goods based on its ability to pay for transport. This is also termed as the 'value of service' principle. Thus, high value merchandises are charged more, as compared to low value commodities and objects of, including foodstuffs and industrial raw products, may be transported at lesser rates. This is highly justifiable and it is from this principle of charging 'what the traffic will bear' that the railways develop authorization for the practice of

categorising commodities into diverse groups, within each of which an ample degree of similarity of conveyance and economic features can be found to justify the application, to each group, of a different scale of basic rates.

- **Cost of service**: Another elementary principle of freight fixation, which is getting progressively more attention is the 'cost of service' principle. Therefore, putting both the principles together, no merchandise should be charged more than it can typically afford to pay for carriage and, as a rule, no less than the actual cost incurred in moving it. For application of this criteria, double attention has to be given to the factors having an effect on the ability of commodity to pay for transport which: (a) value with respect to weight, (b) usages, (c) stage of manufacturing, (d) size of traffic, and also the factors affecting the expenditures of transportation for example, (i) bulk in percentage to weight, (ii) risk of damage, wastage, or deterioration while transporting, (iii) speed of transportation, and ; (iv) size of the traffic.

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As has been stated earlier, government had specified in around 1883 that the 'value of service' was to offer the upper most and the 'cost of service' the ground in shaping the railway freight rates. With the development of road transport and its competitive features, the point of exchange of one mode of transport with another, would establish the operative ceiling on the 'value of service' dependent on rates. The other restraint on the application of the above-mentioned dual principle is the legal prevention against undue partiality and undue prejudgment.

3.2.1 Freight Levels and Rail-Cargo Elasticity

There has been extensive research done to study and analyse the effects of changes in domestic and international rail freight charge elasticity. The overall conclusion drawn from various surveys and researches was that there is profound international evidence available on the estimated levels of such elasticities. The two most remarkable characteristics of the domestic elasticity are that most researches evaluate more possible openness of freight volumes to fluctuations in road, rather than rail freight charges as such; i.e., the cross expense elasticities rather than direct price impacts. This arguably reveals the historic performance of road relative to rail transport and the active policy discourse surrounding intermodal pricing and the treatment of non-priced impacts or external effects of road and rail transport. The railways industry has promoted unambiguous pricing of the external costs of road-use on numerous earlier occasions. Secondly, the comparative beginning of third party rail access costing regimes means that there is an inadequate amount of data points to correctly conclude how rail freight capacities may react to variations in rail access charges alone. This is a significant point since the aim here is to find out suitable estimations of the sensitivity of rails in olden times throughput to changes in rail access prices. Keeping this in mind, a new approach has been adopted taking a percentage of a representative rail freight overall expense elasticity estimate range to estimate a rail access cost elasticity range. This percentage is same as the access charge percentage of the aggregate rail freight charge. Before assessing the rail freight elasticity, a very short explanation of the intuition fundamental to the notion of demand elasticity, as it is related to some of the important values of road and rail transport can prove to be a useful forerunner.

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Freight demand is taken to be inelastic in conditions where there are not many options or where a mode of transportation has some physical or inherent advantage in the conveyance of particular categories of freight covering some journeys. In such circumstances, the demand for freight is categorized as being incontestable – i.e., not affected due to competition through any other mode of transportation. This is because of the important government strategy focusing on decreasing usage of road and boosting more and more rail transport over the past years. This has been shown in the high level of government and industry-sponsored research on road charging.

Freight Elasticity at International Level

One fascinating observation on rail freight elasticity evaluations is that though there are many approximations existing, the range in the prices of these estimates seems to have also increased with due course of time. This is mainly because the usage of different modelling or measurement practises enforced on different sets of commodities provide different elasticity estimations. For instance, a special elasticity is different in comparison to a regular elasticity.

The World Bank sponsored Oum et al (1990) review of rail and road freight market elasticities perhaps carries on to be one of the most wide-ranging till today. It provides a summary of 17 freight studies, including all major commodity groups along North America, UK and the Asia-Pacific. Particularly, Oum et al (1990) provide approximations for all commodities and grains only. These have been shown in the table below.

Table 3.1 *International estimation of rail freight price elasticities*

Freight Type	Range Surveyed	Most Likely Range
All Commodities	-0.60 to –1.52	-0.40 to –1.20
Grains	-0.52 to –1.18	-0.50 to –1.20

It is evident that even the most likely range in estimates from the above table can suggest ample differences in bulk response—elasticity to inelasticity in price. For instance, a given 10 per cent increase in rail freight charges can source a 12 per cent deterioration in all rail cargoes and likewise for volumes of grain, keeping all other factors constant. This is in contrast to the situation where a given 10 per cent increase in rail freight rates consequences in modest volume deteriorations of 4 per cent and 5 per cent for all merchandises and grains, respectively.

Check Your Progress

1. When was the Railway Freight Structure Enquiry Committee established?
2. List the main recommendations of the Railway Freight Structure Enquiry Committee.
3. What are the two most remarkable characteristics of domestic elasticity?

3.3 ROUTE SCHEDULING

The method of developing and planning public transport service is known as 'service planning'. Service planning entails a number of activities which are as follows:

- Network designing
- Route designing and stoppage layout
- Determination of frequency
- Preparing a Train timetable

- Scheduling of trains
- Scheduling of crew

The above mentioned activities are ordered approximately keeping in mind a general sequence of time, and also of a dependency on activities conducted at a higher-level. The general network design of a scheduling a train route is an activity of the highest level, commenced seldom or when prominent new systems are initiated. The network design then provides a component of route design and stoppage layout, in which the more definite physical services for the routes and stoppages/railway stations are instigated. Once routes have been settled, the frequency of service may be decided, and a timetable for train trips on the route may be created. Once the timetable is constructed, schedules for trains on the route and all along the network can be planned upon. Lastly, work shifts for workers can be made (which means creating a crew schedule), and all workers can be assigned different duties.

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The first three activities, enlisted above are comparatively of a more strategic nature, and may only be deliberated upon infrequently by transport planners. Generally, these decisions are reached keeping in mind political and economic considerations, and as such may need vigilant and deliberate by transport planners. The activities like creation of a timetable and scheduling related to train and crew are thought of as more strategic decisions, because the frequency of change in these decisions depends on the whims and fancies of the transport agency's desire to review and change schedules. In most circumstances, these strategic activities are supported by software tools that have the capability to generate extraordinary solutions in a short duration, usually after direct interaction with the planner.

There are numerous ways of scheduling rail transport routes in a network to deliver reasonable rail transit service in and around an area. These might comprise any amalgamation of:

Outward services, concentrating on gathering travellers from faraway areas and bringing them into a main centre, or other important destination; Cross-city or grid routes, concentrating on linking passengers through the area, maybe between radial services or among several smaller trip generators; and, Shortest connections, concentrating on conveying travellers between key trip producers.

Typically, transport networks comprise some mixture of these types of routes, permitting an acceptable level of access to most areas, with a high degree of direct service to key trip producers. Sometimes, such route scheduling might include a mixture of modes. For instance, in some cities, the railway system is predominantly radial, while the bus services move passengers, cross-city and provide circulator services. Other systems, predominantly bus systems, may include both cross-city and radial services, which allows more coverage and larger direct access to end points.

Factors Affecting Route Scheduling

From a transport point of view, scheduling of a route may be categorized in numerous significant ways:

- Geographical coverage of a route is generally influenced by political contemplations as well as intentions to offer movement for populations with lower-mobility.

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- Time-based coverage, defines the time periods when the service will be provided; whether on weekdays or on weekends or on only some days of the week.
- Connectivity (direct vs. indirect service), with the wish to link key trip producing areas with shortest routes but possibly permitting transfer trips to cater to areas not so high in demand.

These features play a prominent role in evaluating demand for the service. Explicitly, the specialist may desire to play with different network arrangements and routes, so as to estimate the level of demand that each network might support. Well-stated models of travel demand should be in a condition to explain geographic and temporal coverage, as well as trip connectivity, in projecting transport usage.

As an essential qualification, most transport agencies do not generally approach network design from the very beginning. Most agencies generally have some prevailing route designs, and related groundwork e.g., stops, terminals, stations, etc., that may ever so often restrain certain route structures or may suggest carrying on with some of the existing routes. Consequently, maximum agencies, while planning on route schedules, consider new features of the network as a complement to the prevailing services, with more some adjustments to the existing routes. Nevertheless, when new modes of service are introduced in rail systems, more substantial reorganization of services may be likely, maybe spreading the existing rail connectivity to new geographical areas, escalating service in current service areas, or complementing the new mode by pointing routes to connect the new modes.

In combination with network design, a route scheduler must also keep in mind specific routes and their aim. The layout of separate routes generally involves some interchange in design, most notably:

1. **Stop density:** Stop density comprises the interchange of traveller access against speed of route. Greater stop density means that more number of travellers will be able to board the train due to stoppages at big and small stations, this allows easier access to transport service. Nevertheless, higher stop density may also mean that the train may be stopping repeatedly, thus decreasing the overall speed of the train.
2. **Route length and indirectness:** Route length includes the exchange of direct service vs. service reliability. Longer routes provide a chance to travellers to reach more possible destinations, as the route offers direct service to a bigger geographical area. However, on the other hand, longer routes may lead to reduced schedule observance, as service may be more disposed to travel time unpredictability and/or service interruptions.
3. **Trip producers:** The route can serve key trip producers or additional unimportant trip producers, or both of them, in combination. Often, routes have stations that correspond with key trip producers, with greater passenger flows happening between these key producer stations. Nevertheless, there may also be a requirement to cater to specific geographic areas with less demand.

Determination of frequency while scheduling a route

There are a many ways that route designers may adopt to decide upon a realistic frequency of service on a route. Following are some common methods that are generally adopted by route designers:

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- **Policy movements:** Rail agencies regulate definite movements that agree with policy objectives, generally related to giving a minimum level of service on a route where the demand is not very high.
- **Minimum movements:** Bus and rail systems have minimum movement system, based on volume restrictions. In circumstances when demand on a particular route is very great, these minimum movements may be utilised to allocate the maximum frequencies on the route.
- **Load management:** In many circumstances where policy movements or minimum movements do not hold well, the characteristic way of deciding frequencies is based on management of load at the peak load point across the route. The peak load point is the point across the route that carries the biggest number of travellers per hour.

If the elasticity of a transport route is pretty high, then that particular route may result in something called the vicious circle. When service is condensed in order to lessen costs, then demand will also decline, which means there will be less riders. If Mohring's formula is applied here for this number of riders, then a drop in the demand with the frequency will be seen and thus riders will lessen again in number. This sequence is called the vicious circle. Alternatively, increase in the frequency can augment the demand and thus increase the number of commuters. If Mohring's formula is applied to this new number, the frequency will escalate again and this phenomenon is called virtuous cycle.

3.4 CARGO CONSOLIDATION

Merging cargo of a number of transporters into one proportion for the purpose of shipping is better recognized as consolidation in the freight industry, may it be transportation by sea, air and rail/road. Consolidation of cargo characteristically includes the cargo conveyance to the packaging point, packing of cargo in container, custom process of shipping documents, and ultimately re-packing (if required) for delivery.

Benefits of Cargo Consolidation

The core principle related to shipping costs is that as the size becomes bigger, per unit shipping cost reduces. In simple terms, it can be understood that consolidating cargo, i.e., combining shipments turns out to be advantageous for shippers as it brings down the general cost of transportation. There are numerous benefits of consolidating cargo other than just saving money, some of these advantages are as follows:

- Quicker transportation time
- Less crowding at stuffing docks
- Less, but durable carrier relationships
- Reduced product handling

Check Your Progress

4. Define service planning.
5. What do you understand by the term vicious circle?

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- Less charges on accessories from consignees
- Less fuel and emissions
- Advantage of dedicated fleets
- Easy supervision of complete distribution chain
- Saving in investment Costs
- Multi modal Transportation
- Reduction in risks
- Control over delivery and production schedules

3.4.1 Arrangements for Pooling at Rail Head and Distribution from Rail Head

In this section, we will discuss about the concept of pooling.

Brief History of Wagon Pooling

In the beginning, with the distinct railways in India, there existed no concept of wagon pooling. Each zonal railway followed the practice of using its own wagon moving on its lines, and railway wagons from foreign railways were run only via specifically discussed agreements among railways of the countries involved in conveyance. For example, much coal loaded by the East Indian Railway was done on its own wagons, and trans-shipped to wagons of other railways at trans-shipment points. The under usage of the wagons in this system came to fore during the First World War, when there was a steep rise in demand of goods traffic. Emergency orders were issued permitting unselective loading of goods on any accessible wagon irrespective of which railway owned it. The Indian Railway Conference Association (IRCA) voted for a review of the new practice and following additional trials, in 1925 a decision was taken as a policy in favour of pooling wagons.

What is pooling?

In the railway jargon, railhead is that place from which railroads and other transport routes begin. Each zone of the Indian Railways owns a fleet of freight wagons. As needed, most freight trains cross through territorial areas of more than one railway zone, and wagons of one railway zone may end their journey outside their home zone after completing their journey. Wagon pooling denotes the practice of permitting railways of other zones to use the wagons for their own freight trains. In effect, the wagons from all zones of the railways are pooled together and booked for goods trains arbitrarily, without any zone offering preference to its own wagons. Pooling largely enhances utilization of wagons, since it evades trans-shipment from wagons of one zone to another, at zonal boundaries, and also evades transportation of an empty to its home zone, which can turn out to be fairly heavy on the exchequer. It also decreases shunting as a result and increases yard and siding utilization.

Wagon pooling is also in practice outside Indian Railways. Sometimes wagons are pooled with non- Indian Railways organizations, e.g., industrial plants, power stations, quarries, coalmines, cement factories, etc. Other than this, sometimes additional wagons are pooled with foreign railways for instance Bangladesh or Pakistan Railways.

Indian Railways wagons go across geographical borders on to the Pakistani and Bangladeshi networks under the cross-border goods traffic arrangement, and likewise trains from those railways ply on the Indian Railways' network. It is not mandatory for these wagons to return straightway, and may sometimes be used for movement of goods outside their home railways—but generally these are sent back fairly soon.

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Challenges related to Pooling

Clearly, with the system of wagon pooling comes the issue of maintenance and overhauling of the rail wagons. As a common rule, railway wagons must return to their home zone every 3 years for a periodic overhaul (POH). This is generally specified as a stencilled scheme. Regular examination and maximum insignificant upkeep of wagons at yards and at stations on the way is carried out by the railway where the wagon happens to be at the time. As a matter of fact, wagons cannot be switched in case of them having serious defects; the railway having the wagon at the time of the defect must fix it on priority.

Wagons belonging to respective zones are counted and traced regularly. Depending on the goods traffic needed by a specific railway, it might need lesser or more wagons than are actually owned by it. A railway crediting its wagons (creditor) actually needs lesser wagons than it actually has, so its surplus wagons are, in operation, given out on rent to other railways. A railway in debt (debtor or borrower), likewise, is one which needs more wagons than it actually owns, so there is a need for it to 'borrow' wagons from the wagon pool to carry on and fulfil all transportation needs. In order to use more number of wagons that a railway owns, rental charges have to be paid by the 'borrower' railway. These charges may be different for different type of wagons.



Working railway: The railway working at the junction point or the point of interchange is called 'working railway'.

Distribution of Wagons while Pooling

At every point of interchange, or junction where interchange between railways takes place, there arises a need to regulate goods traffic in order to maintain the flow of traffic, and to ensure observe to pool targets. This is the reason why Junction Quotas are decided, which stipulate the total wagons to be interchanged every day between individual railways at the point of interchange, in each direction. In case of extremely irregular traffic routes, junction quotas may stipulate a specific number of empty wagons to be reverted in the opposite direction. The railway working at the junction point or the point of interchange is called 'working railway', and the railways interchanging their wagons at that junction are called the 'using railways'. A wagon is exchanged between both railways, i.e., the working and the using railway when it comes into or leaves the junction.



Using railways: The railways interchanging their wagons at that junction are called the 'using railways'.

Equalization is that process of railways which ensures that the flow of wagons in between both the interchanging railways is alike in both directions at the point of interchange. Well, this may not happen always, as the traffic flows on different routes are not balanced and similar. Over equalization, in railway jargon refers to any one railway giving more wagons than it receives in return; whereas, on the other hand, a situation contrary to this leads to under equalization. For example, Northern Railway hands over coal wagons from Eastern Railways to Western Railway at Agra East Bank, and is over equalized with to Western Railway, for the reason that Western

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Railway does not give the wagons back to Northern Railway by the same route. Western Railway gives the free empty wagons to Central Railway in the opposite direction— it is over equalized with Central Railway; the empty wagons (also known as empties) are passed over Central Railway and to South Eastern Railway and back to the mine regions. The state can be more complicated if the wagons are not empty on their return journey, rather are being put into use for some other highly directional goods traffic on the backward journey. Instructions have been issued by the DWI with respect to junction quotas and equalization. Strict equalization is not always the need of the hour—railways habitually over equalize with another railway at one junction but under equalize to a similar amount at another.

At each interchange junction, wagons designated for interchange are made to undergo inspection. A defect found in a wagon may be categorized as a penalty defect in certain situations, and is racked up as a charge to the railway to which the wagon belongs. A defect which is serious to the degree that the wagon is rendered unfit for use is classified as a rejection defect and the wagon is retained with the railway which offers, the railway might offer the same again after rectifying the defect.

3.4.2 Dedicated Rail Sidings for Bulk users

A siding, in railway jargon, means a low-speed track section separate from an active railway line or through route for instance a main line or branch line or spur. It may be linked to through track or to other sidings at one of the ends. Sidings, at railway stations often have lighter rails (which move at lower speed), or light train traffic movement, and few, if any, signals. Sidings which are linked at both ends to an active line are usually called loops; or else they called single-ended sidings or dead end sidings, or in case of short endings they may also be called stubs.



Siding: A siding, in railway jargon, means a low-speed track section separate from an active railway line or through route for instance a main line or branch line or spur.

Types of Sidings

Sidings found at railway stations have numerous uses, they might be utilized for marshalling, storing, stabling, loading and unloading vehicles. Sidings may be of various kinds, such as follows:

- Common sidings store rolling stock, particularly for the purpose of loading and unloading.
- Second variety of sidings are called industrial sidings which are meant for factories, mines, collieries, docksides, warehouses, some out of these are important links to industrial railways. At times these type of sidings may also be present at big railway stations which are actually meant for public utilization.
- Some sidings may be equipped with maintenance of way or other equipment, permitting trains to pass, or providing help to store helper engines in between travels.
- Sometimes there are sidings present on stations which are seldom used, having been made, for instance, to facilitate an industry, a railway yard or a stub of a railway that has been closed since long.
- Another kind of siding, which is internationally known as the passing siding. Passing siding is that section of track running corresponding to a through line and linked to it at both ends by switches.

Sidings let trains moving in opposite directions to cross each other, and for fast moving, important trains to cross slower or less important trains moving in similar direction. Sidings are significant for operating competence on single track railway lines, and add to the volume of other lines. The track laid out for a siding may be built of lighter rail than the key track. The rail used may not be constantly welded rail, but somewhat hinged by angle bars. The owner of the railway might lay less importance on the value of the ties and the counterbalance used on the siding as in comparison to the one used on its main track. A siding may not get or perhaps might not even need, the same amount of inspection and upkeep that the busier, main track may need or require. Therefore, just because of these reason,s a siding might have a lower designated train speed or on the other hand, it could be a decision taken, keeping business in mind in order to operate at a slower speed on the siding that can help in the cost reduction related to resources and maintenance.

Advantages of rail Sidings

Rail sidings offer the following advantages in transportation of cargo:

- **Cost effective:** With the help of rail sidings, multiple wagons can move on the tracks, in same or different directions at any given time. This helps in good portion of freight movement at the same time, and also proves to be cost effective.
- **Easy delivery:** With the help of rail sidings, cargo can be carried right to the factory, mine, shaft, dockside, warehouse, etc., doing away with the need for trucks or other vehicles for delivery to the ultimate destination. Staff of that particular organization can easily unload shipment from the line and place it safely at the storage place following a simple procedure.
- **Business enhancement:** Having the ease of merchandise being delivered right up to the warehouse enables workers to effortlessly put shipments on the shelves while tracking logistics. This means that the goods meant for sale can be sent out to consumers as soon as possible, which helps in business enhancement, allowing he business owner to earn profit without delay.
- **Unaffected by weather and other conditions:** Weather conditions and other troubles, for instance traffic jams, do not have much effect on railroads in comparison to the traffic moving on road. In addition, trains offer more permanency and safety in comparison to freight carriage via trucks on road. In other words, trucks or other vehicular traffic moving on roads is more prone to accidents, whereas rail sidings are far safer in comparison. Therefore, rail sidings enthuse more confidence in transportation of freight from one point to another, in a safe and secure manner.
- **Eco-friendly:** Using rail in place of trucks or lorries minimizes the ill effects of carbon emission due to vehicular movements on road.

3.5 TECHNOLOGY, COST, SPEED, SECURITY AND DYNAMICS IN RAILWAYS

The current time is a new and stimulating time for railways. Trends in technology are constantly changing the association between service providers as consumers. Intrinsically,

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Passing siding: Passing siding is that section of track running corresponding to a through line and linked to it at both ends by switches.

Check Your Progress

6. What is the core principle related to shipping costs?
7. List some benefits of consolidating cargo.

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keeping the current scenario in mind, the correct approach of rail service providers is to participate positively in the environment and make new changes and remain continually connected with travellers and other service users in order to provide best possible services and beat competition. Railways are making a dedicated effort to reorganize operations, enhance output, improve revenue, be in touch with travellers in real time, and provide a personalised experience by making use of appropriate technology and the result of all these concerted efforts is more satisfied customers and better profitability.

Technological Advancement in Railways

Use of computers and other means of technology have helped railways impact a consumer's travel or transportation experience in many ways. Let us have a look how:

- **Personalised satisfaction:** Variety of travellers and consignees have numerous expectations in terms of services provided by railways. Keeping that in mind, railways offer their customers extras which helps in creation of a personalised experience. Indian Railways, for instance, started an e-bedroll service that lets travellers book bedroll kits at the time of online booking, in addition they also have an option of selecting bed sheets, pillows and blankets.
- **Artificial intelligence:** Seeing the way technology is advancing in the world, soon artificial intelligence in the form of robots will take over the world. Well, perhaps there might be some time for that to happen but, artificial intelligence is ready to make a whole lot of difference in the world of travel and transportation. In the rail sector, Voyages-sncf.com is a primary adopter of chat bots with intelligent language processing competences that work with customers, actually lessening the burden on call centres and augmenting the satisfaction of rail travellers and consignors.
- **Virtual and improved reality:** The possibility of this technology for travellers and consignors is something beyond anybody's imagination. Chinese railway manufacturer CRRC presented at Innotrans 2016 its 'magic train window', which is a passenger information system supported by satellite, which converts train windows and mirrors into interactive display windows providing information related to the landscape that the train is crossing at that time.
- **Open data:** The latest trend in the field of technological advancement in railways is open data. The Association of Train Operating Companies in Britain are considered to be the pioneers in this area as they opened up their data to the world. Thus was created the website Trains.im, which is a site that helps a passenger map out his journey, effortlessly access all trains between two stations on any particular a day, check routing and expected transitional times for all train journeys and maps of the route.
- **Big data scrutinisers:** Understanding of a passenger's behaviour allows railways to provide a more natural customer experience. From providing additional services to providing recommendations related to supplementary destinations to visit as part of a promotion to the rail journey of the passenger, big data will provide numerous chances to make rail experience better.
- **Collaborative economy:** Collaborative economy is perhaps not a new concept, but it continues to grow and improve with each passing day. The taxi provider

service Uber, for instance, is planning to partner with Indian Railways not just to join its service within the Indian Railways app, but also to carry travellers to and from the railway stations by introducing cab booking booths at maximum railway stations.

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Cost and its Effect on Speed

Costing in railways means the calculation of the variable and constant costs of movements by rail. Costs that fluctuate with changes in volumes of traffic or levels of service and comprise fuel, maintenance and train crew costs, for instance are said to be variable costs. Constant costs on the other hand are usually related to things like head office, interest charges and other overheads. Unit costs can then be found out based on the expenditure incurred by the railway distributed into standard classifications.

Types of Cost

There are numerous types of costs which the railways incur during operation of transporting people and goods, these costs include:

- Maintaining and operating ways and constructions or buildings, like railway tracks, railway signals, communication systems, railway stations, rail sidings, etc.
- Maintaining and operating equipment, like engines, freight wagons, intermodal paraphernalia, and work apparatus.
- Railway operations, for example operations in the trains and at the yard, controlling trains, and intermodal expenses.
- General costs, like cost incurred in administration, benefits to employee, taxes paid, expense on insurance, purchase of material, etc.
- Capital cost
- Depreciation cost

All the above mentioned expenses have an effect on the speed and frequency of the rail movement of all countries. Lesser the costs incurred higher is the speed maintained and number of trains can move all across the length and breadth of the country with a higher frequency. Indian Railways is ambitious to escalate the speed of trains carrying passengers to 160–200 km/h on devoted conventional tracks. They plan to develop their current conventional lines to be able to cater to speeds of up to 160 km/h), with a goal of speeds above 200 km/h on new tracks with enhanced technology.

In the beginning, trains will go up to the highest speed of 160 km/h. Thereafter, railway cars that can move at the speed of 200 km/h will be produced at and delivered from Railway Coach Factories of the country. Though semi-high speed railway cars are being manufactured by Indian Railway coach factories, but the tracks all over the country do not have the capability to support these fast moving coaches.

Dedicated Freight Corridors which have been planned to come up across India will shift freight traffic from all most all current passenger railway tracks and this will result in an increase in the speed of the passenger trains to 200 km/h as is being planned.

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The Chinese Railways conducted an operation from 1997 to 2007 to escalate the speed of trains. The campaign was executed in six rounds and improved average speed of passenger trains in China from 43 km/h to 70 km/h. Numerous prevailing railway tracks were improved so that trains could move on them at the speed of 250 km/h. Broad-gauge is used in India, so it is anticipated that such a campaign if executed in our country will intensify the average speed to 90 km/h, presently the average speed of India's express trains is 50.9 km/h.

French National Railways (or SNCF) made a proposal to upgrade the Shatabdi train track amid Delhi and Chandigarh so that trains could run at a speed of 220 km/h. If this venture sees the light of day, it is expected to offer direct know-how for Indian Railways to run semi-high speed trains all through the country, specifically running trains like Rajdhani and Shatabdi at a high speed 220+ km/h with average speed of 150 km/h.

India's pursuit to run rails at the 160 km/h is not free from criticism. There is grave doubt raised about the safety of the travellers and the cargo being ferried from one place to another. As the semi-high speed trains have not been equipped with the right kind of infrastructure that is required to run such high speed trains, for instance, it is preferable to run these trains on 60 kg tracks, but currently they are being run on 52 kg tracks. Numerous railway projects which are in different stages of implementation such as track doubling, electrifying the tracks, laying of new track, gauge changing, etc. However, Indian railways has not come up with any guidelines to channelize all current and new efforts to run trains at semi-high speed.

Railway Security

The Railway Protection Force (RPF) is a security force of India delegated with the job to protect railway passengers and cargo, railway area and property of the railways. This is the only Central Armed Police Force (CAPF) which has been empowered to arrest, investigate and prosecute offenders. The RPF works under Railways Ministry of India. The force has a strength of nearly 65,000 personnel.

The basis of this force was to watch and ward and it worked under the managerial control of the railway administration. Subsequently, it began to be called Railway Protection Force and its personnel were given the power to arrest without warrant, anyone in unlawful possession of railway property. The term 'railway property' comprised only the properties owned by the railway administration. In times to come, the definition for the term railway property was made comprehensive and it began to include the properties owned by, or in the charge of or entrusted with the railways. The wrongdoers are charged under the Railway Property (Unlawful Possession) Act 1966 which is shortly came to be known as RP(UP) Act 1966. Today the Railway Protection Force has a distinct administrative system and works under the general supervision of the Railway Administration.

Objectives of the Railway Protection Force

- To pursue an insistent fight against lawbreakers in protecting passengers, cargo, passenger area and railway property.
- Assist travel and security by getting rid of all anti-social elements from trains, railway premises and passenger area.

- Stay watchful to avoid trafficking in women and children and take suitable action to rehabilitate deprived children found in railway areas.
- Collaborate with other sections of the railways in enhancing the effectiveness and image of the Indian Railways.
- Be the link between the Government Railway Police/local police and the railway administration.
- Embrace all contemporary technology, best human rights practices, management practises and special measures for protection of women, senior citizens and children passengers, in order to achieve these objectives.

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3.6 RAILWAYS VS OTHER MODES OF TRANSPORTATION

Different means of transport are the way by which people and freight is moved from the place of its origin to its destination. They are compartmentalized into one of three rudimentary types, based on what surface they travel, e.g., land, water and air. Transport systems, e.g., railways, roadways, seaways, airways, inland waterways, etc., institute the organization of India's fiscal system. Railways and roadways, both, at present provide over 95 per cent of transportation in the country, other means of transport play a relatively minor role. There is a good reason to believe that rail-road harmonization has been a significant characteristic of the transport policy adopted by the Indian Government. The overall aim, no doubt, is to secure the appropriate synchronisation of different modes of transportation obtainable in the country and to escape uneconomical competition among them. Every method of transportation is categorized by a set of technical, operational and commercial characteristics:

- **Road transportation:** Road setups are large users of space with the least amount of physical restraints among different modes of transportation. Nevertheless, physical restraints are substantial in road construction with considerable superfluous costs to overcome topographies such as water bodies or rugged landscape. While traditionally road transportation was established to provide support to non-motorized forms of transportation, it is primarily vehicular movement that has been responsible for most of its development since the early 20th century. Road transportation has an average effective elasticity as vehicles can come in handy for numerous purposes but are hardly able to move on any other surface than roads. Road transport systems are high on maintenance, in terms of vehicles as well as infrastructures. They are primarily linked to small industries where quick movement of freight in small quantities is the set standard. However, with the advent of containerization, road transportation has come to be an important link in conveyance of freight.
- **Pipelines:** Pipeline routes are almost boundless as they can be laid on land or under water. The longest gas pipeline links Alberta to Sarnia (Canada), which is 2,911 km in length. The longest oil pipeline is the Transiberian, extending over 9,344 km from the Russian arctic oilfields in eastern Siberia to Western Europe. Physical restraints are less and pipeline laying costs differ according to the thickness of the pipe and escalate correspondingly with the distance and with

Check Your Progress

8. Define costing in railways.
9. List the types of costs.
10. What is RPF?

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the thickness of the content they carry (from gas, low viscosity, to oil, high viscosity).

- **Maritime transportation:** Maritime is the most effective mode transportation because water confers buoyancy which reduces friction to the minimal, thus large quantities of cargo can be carried over long distances with ease and in cost effective ways. Chief maritime routes consist of oceans, coasts, seas, lakes, rivers and channels. Nevertheless, due to the location of economic activities maritime circulation takes place on specific parts of the maritime space, particularly over the North Atlantic and the North Pacific. The creation of channels, locks and dredging are endeavours to expedite maritime movement by decreasing discontinuity. Maritime transportation incurs high ultimate costs, because port setups are among the most expensive to create, maintain and work upon. More than any other means of transportation, maritime transportation is connected with heavy industries, like steel and petrochemical facilities neighbouring port sites.
- **Air transportation:** Air routes are virtually unlimited. Air transportation is weighed down by multidimensional restraints which are- the airport site, the climatic conditions, aerial currents and so on. Air activities are connected with the tertiary and quaternary sectors, notably finance and tourism, which are based on the long distance movement of people. In the recent past, air transportation has been accommodating developing quantities of high value freight and is playing an ever increasing role in global logistics.



Intermodal transportation: It is the use of two or more modes, or carriers, to transport goods (freight) from shipper to consignee.

- **Intermodal transportation:** In this type of mode, a variety of modes are clubbed together in to derive particular advantages of each mode. Though intermodal transportation relates mainly to passenger movements, such as the utilization of the diverse, but interrelated means of a public transport system, it is seems to have had the most significant impacts over freight transportation. Containerization has been the chief factor of intermodal integration, allowing maritime and land transportation modes to work together in synchronisation more effectively.
- **Rail transportation:** Last but not the least, railways are made of a sketched path on which vehicles with wheels are bound to move. Keeping in view the recent technological developments, rail transportation has come to include monorails and maglev. Rail cars have an average level of physical restrain related to the type of engine and a low gradient is required, mainly for freight. Railways are most suited for carrying load from heavy industries, containerization has proven to improve the flexibility of rail transportation by connecting it with road and maritime modes (intermodal transportation). Rail transportation, undoubtedly has been by far the mode of land transportation offering the maximum capacity with a 23,000 tons fully loaded coal unit train being the heaviest load ever carried. Gauges, however, vary around the world, often challenging the integration of rail systems. Rail transport is also accepted to be a 'green' transport option, as trains burn less fuel than trucks, lorries or other vehicles moving on road. Above this, a train having as many as 100 wagons attached can be driven only by one driver to its destination.

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Advantages of Rail Transport in India

Having gone through the comparison between rail and other modes of transportation we are able to understand how railways have an edge over the other modes Let us now look at the advantages of rail transportation from the Indian perspective. How rail transportation has been facilitating the economic and otherwise development of the country and how it is determined to do so in the future.

1. **Development of agriculture:** Spread of railways in India has helped a great deal in the agricultural development of the country. Before the expansion of railways, agriculture was mainly concerned with subsistence. Railways have given it a commercial angle. Farmers of the country are able to transport their produce for sale to far off markets at reasonable cost via secure means through trains.
2. **New sources and new areas of production:** Railways have set forth new sources and new areas of production. They are responsible for not only providing knowledge of the new areas, but also helping out to reach areas inaccessible by road.
3. **Growth of markets and specialization:** The credit of substantial increase in the size of markets and thus stimulating the process of specialization can in no uncertain terms be attributed to railways. By this means of transportation, it is extremely easy to transport bulky goods from their place of production to potential markets (far and near).
4. **Beneficial in the internal trade:** By linking different areas, even remote, of the country, railways have expedited internal trade in leaps and bounds. Goods and passengers can be easily carried to distant places.
5. **Movement of labour and capital:** Railways have improved the agility of labour and capital which in its turn has helped in the development of the country.
6. **Check on the variation of prices:** Railways have successfully checked variations in prices that were harmful to the economic, political and social steadiness of the country. Price variations become a cause of misery end up disturbing trade thus giving rise to countless problems.
7. **Help in famines and other such natural calamities:** Railways have helped in reducing the ruthless force of famines and other natural calamities by transporting food-grains from surplus to famine-struck areas.
8. **Source of employment:** Railways are one of the main sources of employment in India. Lakhs of skilled and unskilled individuals get employed in operation of railways. Furthermore, railways also creates abundant opportunities of indirect employment such as food stalls, or book shops at railway stations; caterers providing in train catering services are just to name a few. Railways provide employment to roughly 17 lakh people all across India.
9. **Backbone of tourism:** Tourists, especially domestic, find trains the most convenient means of transport for fulfilling their urge to see different places in the country. Almost all big and small towns/villages of the nation are linked via railways, hence providing easy and affordable travel. In addition to his railways also provide circular tickets to tourists and thereby promote tourism.

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10. **Strategic importance:** Strategic importance of the railways cannot be overlooked. This means of transport is instrumental in providing internal security and in making goods and efficient arrangements of defence of the country against any external threat.

11. **Social importance:** By providing an accessible and cheap means of transport railways have made possible a basic change in the social attitude of the people. They are no longer tied to their native orthodox, old customs and traditions as they are able to compare and bring positive changes in their way of life courtesy travel across the country.

3.7 SUMMARY

Some of the important concepts discussed in this unit are:

- In 1905, a universal grouping of goods related to overall railways, conditional to certain exclusions, was developed by the Traffic Simplification Committee set up by the I. R. C. A. and this grouping was reported in the tariff of July, 1910.
- The need for adjusting freight rates, or estimating different rates and to help industries grow in India was emphasized upon by the Indian Fiscal Commission in 1922.
- With the incorporation of the railway systems about 1948, it was the right time to evolve a standard freight rate structure. The rail freight arrangement was revised in October, 1948 presenting the telescopic principle and removing numerous 'station-to-station' rates as well as the system of charging inflated distances.
- The Railway Freight Structure Enquiry Committee was established in June, 1955 by the Ministry of Railways to appraise the then prevailing railway freight structure and to recommend, among other things, changes keeping in mind the requirements of the developing nation and the requirement for preserving the economic stability of the railways.
- Indian Railways transport a mixed variety of goods; resources, end products, consumables, goods in wholesale and in bags, fluids, objects of high as well as low value, delicate and hazardous goods, construction goods, medicines, chemicals and drugs, cloth (raw and finished), footwear and vital food products, and so on.
- To fix the freight charges for conveyance of these diverse cargoes, over long as well as short distances and under changing conditions, is plainly a very complex matter and cannot clearly be brought down to a fixated scheme.
- The World Bank sponsored Oum et al (1990) review of rail and road freight market elasticities perhaps carries on to be one of the most wide-ranging till today. It provides a summary of 17 freight studies, including all major commodity groups along North America, UK and the Asia-Pacific.
- Typically, transport networks comprise some mixture of these types of routes, permitting an acceptable level of access to most areas, with a high degree of direct service to key trip producers.

Check Your Progress

11. What do you understand by intermodal transportation?
12. Mention advantages of rail transport in India.

- Stop density comprises the interchange of traveller access against speed of route. Greater stop density means that more number of travellers will be able to board the train due to stoppages at big and small stations, this allows easier access to transport service.
- Route length includes the exchange of direct service vs. service reliability.
- Merging cargo of a number of transporters into one proportion for the purpose of shipping is better recognized as consolidation in the freight industry, may it be transportation by sea, air and rail/road.
- The core principle related to shipping costs is that as the size becomes bigger, per unit shipping cost reduces.
- Pooling largely enhances utilization of wagons, since it evades trans-shipment from wagons of one zone to another, at zonal boundaries, and also evades transportation of an empty to its home zone, which can turn out to be fairly heavy on the exchequer.
- Wagon pooling is also in practice outside Indian Railways. Sometimes wagons are pooled with non- Indian Railways organizations, e.g., industrial plants, power stations, quarries, coalmines, cement factories, etc.
- A siding, in railway jargon, means a low-speed track section separate from an active railway line or through route for instance a main line or branch line or spur.
- Railways are making a dedicated effort to reorganize operations, enhance output, improve revenue, be in touch with travellers in real time, and provide a personalised experience by making use of appropriate technology and the result of all these concerted efforts is more satisfied customers and better profitability.
- Costing in railways means the calculation of the variable and constant costs of movements by rail.
- The Railway Protection Force (RPF) is a security force of India delegated with the job to protect railway passengers and cargo, railway area and property of the railways.

3.8 ANSWERS TO 'CHECK YOUR PROGRESS'

1. The Railway Freight Structure Enquiry Committee was established in June, 1955 by the Ministry of Railways.
2. The main recommendations of the Railway Freight Structure Enquiry Committee were as follows:
   - Fundamental reconsideration of the design of the legs of the telescopic freight structure
   - Setting a wagon-load grouping and a 'smalls' grouping for all merchandises
   - Elimination of station charges by taking these into thought in developing the revised freight structure
   - Discontinuance of the distinct tax of transhipment /ghat charges

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3. The two most remarkable characteristics of the domestic elasticity are as follows:
   (i) Most researches evaluate more possible openness of freight volumes to fluctuations in road, rather than rail freight charges as such; i.e., the cross expense elasticities rather than direct price impacts.
   (ii) The comparative beginning of third party rail access costing regimes means that there is an inadequate amount of data points to correctly conclude how rail freight capacities may react to variations in rail access charges alone.
4. The method of developing and planning public transport service is known as 'service planning'.
5. If the elasticity of a transport route is pretty high, then that particular route may result in something called the vicious circle.
6. The core principle related to shipping costs is that as the size becomes bigger, per unit shipping cost reduces.
7. There are numerous benefits of consolidating cargo other than just saving money, some of these advantages are as follows:
   - Quicker transportation time
   - Less crowding at stuffing docks
   - Less, but durable carrier relationships
   - Reduced product handling
8. Costing in railways means the calculation of the variable and constant costs of movements by rail.
9. There are numerous types of costs which the railways incur during operation of transporting people and goods, these costs include:
   - General costs, like cost incurred in administration, benefits to employee, taxes paid, expense on insurance, purchase of material, etc.
   - Capital cost
   - Depreciation cost
10. The Railway Protection Force (RPF) is a security force of India delegated with the job to protect railway passengers and cargo, railway area and property of the railways.
11. In intermodal transportation, a variety of modes are clubbed together to derive particular advantages of each mode.
12. Advantages of rail transport in India are as follows:
    - Development of agriculture
    - New sources and new areas of production
    - Growth of markets and specialization
    - Beneficial in the internal trade

3.9 QUESTIONS AND EXERCISES

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Short-Answers Questions

1. List the advantages of rail sidings.
2. What are the objectives of the railway protection force?
3. Write a short note on route scheduling.
4. List the factors that affect route scheduling.
5. What are the challenges related to wagon pooling?

Long-Answers Questions

1. Discuss the general principles for assessing railway freight policy.
2. Explain freight elasticity in domestic and international level.
3. Describe the various benefits of cargo consolidation.
4. Identify and explain the types of sidings.
5. How has the advancement in technology helped railways?

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UNIT 4 ROADWAYS AND LOGISTICS CONTOURS

Structure

4.0 INTRODUCTION

Road transport actually refers to transportation of goods and people from a place to another via roads. Road is a course joining two or more destinations, which has been either surfaced or made suitable to allow movement of motorised and non-motorised vehicles. Road transportation has many advantages in comparison to other means of transport. The investment needed in the construction of road transport is far less than other modes of transportation for example, railways or airways. The cost of construction, operation and maintenance of roads is less than that of laying the railway tracks.

Road transport can be categorised as either conveying materials or people. The main advantage of road transportation is that it enables door-to-door delivery of cargo and can provide a very reasonable means of ferrying, loading and unloading things. At times, road transport is the only means of carrying merchandises and individuals to and from rural areas which are not connected to other developed places by any other means such as rail, water or air. Delivery of goods to various cities, towns and small villages is made likely only by means of road transport. However, despite numerous qualities, road transport is bound by prominent confines. For example, transportation through road is more prone to accidents and vehicular damage. Thus, road transport is not as safe in comparison to other means of transport. Road transportation is less organised as compared to its other transportation counterparts. It has often been found to be irregular and undependable. Road transportation costs are also not very stable and homogeneous. Transportation of bulky goods over long distances turns out to be cumbersome and expensive. Road transport also impacts the environment in a

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negative way as the vehicles moving on the roads emit a lot of pollution, which is bad for the respiratory system of all the living beings at large and also adds to the severe threat of global warming.

4.1 UNIT OBJECTIVES

After going through this unit, you will be able to:

- Explain roadways as primary and secondary mode of transportation in logistics
- Discuss the features, facilities and suitability of roadways
- Describe the factors influencing choice and growth in road logistics
- Identify the suitability for different cargo and distance ranges segments
- Examine the innovative schemes to popularize rail logistics in India
- Discuss the share of railways in cargo movement in India and worldwide

4.2 BASIC CONCEPTS OF ROADWAYS

In this section, we will learn about the significance, classification, features, facilities and suitability of roadways.

Roadways have been existent in India for around 5000 years. In early Indian history efforts were made by Ashoka and Chandragupta for constructing roads. But the actual development of roads happened during the Mughal period. Many roads were constructed during the Sultanate and the Mughal era. Most of the current trunk routes are laid on these erstwhile Mughal routes. These routes were crucial for the strengthening and consolidation of the empire. Before learning about the classification of roadways, let's learn a little about the significance of roads.

4.2.1 Significance of Roads

Roads play a very important role in the development of a nation's economy, let's examine how:

- Roads are important for the transportation of goods and passengers for short and medium travels. When compared to railways, road transport is more accessible, faster and more flexible. For short distance travel and traffic, road transport is the perfect mode of transport.
- Roads are easy and cheap to construct and maintain, in comparison to other means of transport.
- The system of road transportation creates easy interaction between farms, fields, factories and markets and delivers door to door service.
- Roads offer far higher negotiability in terms of gradients and turns which railways is unable to provide. It is because of this trait that roads can also be built on hilly terrains.
- Roads are one of the main feeders to railways. In the absence of good roads, it won't be possible for railways to collect abundant produce for making their operation effective.

- Transportation by road is far less rigid than that by railways. It is possible to stop buses and trucks anywhere and at any time on the road for loading and unloading cargo or picking up and dropping passengers, whereas trains can be stopped only at stipulated stations.
- Perishable commodities like vegetables, fruits and milk are transported more easily and quickly by roads than by railways.
- Road transport can link up backward and internal remote areas of the country to the more developed areas. In India, a large part is still completely inaccessible either through railways or water transport. In such a situation, road transport can certainly link such remote areas with the outside world where railway penetration is difficult.
- Road transport is complementary to railway and other modes of transport. It is only through feeder roads railways can collect its passengers and goods easily. Railways cannot connect villages of the country but through feeder roads, road transport can easily connect railway stations with distant villages.
- Road transport plays an important role in the agriculture sector of the country as it offers easy and speedy transportation facilities for selling agricultural produce specially the perishable foodstuffs like vegetables, fruits etc. The road transport system provides help to the farmers to collect inputs such as seeds, fertilizers etc. to the farming field accompanied by providing accessibility to a stable and equipped market for their produce.
- Road transport is extremely essential for the industrial development of a country. Formation of modern and colossal industries has been possible only because of construction of well-developed network of roads in the country.
- Road transport system is also responsible for generating employment in the country. Construction of roads is enlarging the scope for employment through the improved mobility of people to different regions.
- Road transport is extremely important with regard to a country's defence. A thorough defence system can only be sustained with the help of well-developed network of roads all across the length and breadth of a country. Building roads in remote and difficult regions helps the defence force of the country to obtain control of such areas.

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4.2.2 Classification of Roads (Primary and Complementary modes of Road Transportation):

Roads in India have been classified into different categories on the basis of their functionality or by their roles.

A. Primary Roads

The primary classifications of roads are: (i) National Highways (ii) State Highways (iii) District Roads and (iv) Village Roads. Let's now have a look at each category in brief:

1. National Highways

The main roads laid and preserved by the Central Public Works Department (CPWD) are given the name of National Highways. These roads facilitate inter-state and tactical



National Highways: These are roads which facilitate inter-state and tactical defence movements and link the state capitals, large cities, significant ports, important railway junctions and also provide a link with border roads.

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defence movements and link the state capitals, large cities, significant ports, important railway junctions and also provide a link with border roads.

There has been a considerable increase in the length of national highways in the past years. At present, the entire length of the National Highways in India stretches to roughly 97,991 kilometres. National Highways are the life support of road transport and establish the road framework in India.

Some Significant National Primary Roads of the Country

Numerous national highways are laid through the length and breadth of the country in all directions connecting important places with each other:

- National Highway 1 (main national highway of the country) connects Delhi and Amritsar.
- National Highway 2 connects Delhi and Kolkata.
- National Highway 3 connects Agra and Mumbai going through Gwalior, Indore and Nasik.
- National Highway 7 is the longest link which connects Varanasi with Kanyakumari through Jabalpur, Nagpur, Hyderabad, Bangalore and Madurai. It crosses a distance of 2,325 km.
- National Highway 5 and 17 move along the eastern and western coasts separately.
- National Highway 15 signifies the border road in the desert region of Rajasthan and is laid through Kandla, Jaisalmer, Bikaner and links the border road in the Punjab.

In order to enhance the economic progress of the country, the Government has initiated a colossal National Highways Development Project (NHDP) in India. This may be, is one of the biggest road development programmes ever undertaken by any country with such a short completion timespan for. It is being implemented by the National Highways Authority of India (NHAI). Under this project, around 14,279 km long National Highways were planned to be upgraded to 4 or 6 lanes, this upgradation work costed around ₹ 65,000 crore. The project was completed in two, Phase I and Phase II. Following are the components of the National Highways Development Project Phase I and Phase II:

(i) The Golden quadrilateral (5,846 km) linking four metro cities of Delhi, Mumbai, Chennai and Kolkata.

(ii) The North-South and East-West corridors (7,300 km) linking Srinagar in the North to Kanyakumari in the South and Silchar in the East to Porbandar in the West.

(iii) Port connectivity and other Projects (1,133 km).

As of May 2017, additional introduction NHDP phases up to NHDP Phase VII has been brought about. Except Phase VI, work in all other NHDP phases are currently under progress in varying degrees of completion.

2. State Highways

State Highways are built and looked after by state governments, these roads link the state capitals with district headquarters and other significant towns of the state. State Highways are also linked to the National highways. The state roadways spans about 1,62,5272 kms in India.

Though constructing and maintaining State Highways is the job of the respective state governments, nevertheless with the overhauling of the Central Road Fund (CRF) in the year 2000, the Centre gave a provision of about ¹ 1,000 crores for expansion and development of State Highways. In addition, to encourage inter-state facilities and also to help the State governments in their financial growth via construction of roads and bridges, central government gives 100 per cent funding for inter-state connectivity and 50 per cent grant for projects of financial importance from CRF. Loan support from outside funding agencies is also adopted by some states.

If we look at the entire expanse of the State Highways, we realise that the State Highways have been very unevenly distributed. As per Niti Aayog, up until 2011, Maharashtra (32,596 km) has the longest stretch of State Highways, followed by Karnataka (20,770 km) and Gujrat (18,480 km). Smaller states like Goa and states in highlands e.g. Mizoram, Sikkim, Nagaland, Tripura, etc. have merely less than 700 hundred km long State Highways.

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State Highways: It refers to the roads that are built and looked after by state governments, these roads link the state capitals with district headquarters and other significant towns of the state.

3. District Roads

These roads link the district headquarters with other places of the district. Zila Parishads of the district are responsible or the development and maintenance of these roads. The District roadways is India currently span around 4,67,763 kms. Previously most of the district roads did not have a surface and there was also a lack of bridges and watercourses. But the present day change is more than evident and most of the roads are now surfaced. Improved condition of roads has resulted in improved connectivity and have paved way for economic growth.



District roads: These roads link the district headquarters with other places of the district.

4. Village Roads

Roads constructed in village are primarily the responsibility of village panchayats and they link villages with the towns and cities situated in neighbourhood. These roads are not very well constructed muddy tracks which are unusable during the rainy season. Constant efforts have been made in the past to connect villages of the country with well surfaced, metalled roads. These roads span approximately 26,50,000 kms. Though a substantial increase has been seen in the expansion of village roads, yet about 10 per cent of the villages having a population of 1,000 or more and 60 per cent of the villages with less than 1,000 people are not accessible by pucca roads. There is a need to expand and upgrade existing kuchcha village roads to pucca, all-weather roads.



Village roads: These roads are constructed in village are primarily the responsibility of village panchayats and they link villages with the towns and cities situated in neighbourhood.

A vigorous push was given to village roads at the time of the launch of the Pradhan Mantri Gram Sadak Yojna in December 2000. This scheme is completely sponsored by the Centre to ensure rural connectivity to those unconnected villages which have a population of 500 people (in plains) and 250 or more people in (hilly, desert and tribal areas) in rural India by the end of the Tenth Plan period. The expanse

of Pradhan Mantri Gram Sadak Yojna has been extended to comprise both construction of new links and improvement of existing routes related to such link routes to form a complete sub-network for linking villages with the markets.

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A survey conducted to recognise the core network as part of Pradhan Mantri Gram Sadak Yojna showed that over 1.70 lakh unconnected villages required to be assumed under this programme, meaning the construction of new 3.68 lakh kilometres rural roads costing approximately '†1, 33,000 crore.

B. Complementary Roads

Till now we have seen the categorization of roads under primary roads category, now will read about the types of complementary roads:

1. **Border Roads:** Border Roads Organisation (BRO) Board was instituted in May 1960 for speeding up financial progress and consolidation of defence readiness by way of quick and co-ordinated upgradation of roads in the northern and north-eastern border areas. The BRO has built world's highest road linking Chandigarh with Manali in Himachal Pradesh and Leh in Ladakh. This road runs at an average height of 4,270 metres above sea level and crosses four passes at altitudes ranging between 4,875 and 5,485 metres. It is a crucial road link in the western Himalayas and has significantly lessened the distance between Chandigarh and Leh.

   The BRO has now expanded its activities all through the country and is currently emphasising upon the work of road building in the states of Rajasthan, Jammu and Kashmir, Himachal Pradesh, Maharashtra, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Sikkim, Assam, Meghalaya, Nagaland, Tripura, Manipur, Mizoram, Arunachal Pradesh, Bihar and Andaman and Nicobar Islands.



Urban road: It is a road which lies within the boundaries of the area of municipality, military cantonment, port or railway authority.

2. **Urban Roads:** A road which lies within the boundaries of the area of municipality, military cantonment, port or railway authority is known as an urban road.



Project road: It refers to a road inside the boundaries of the zone of a development project of a public authority for the utilisation of means such as forests, irrigation, hydro-power, coal, sugarcane, etc.

3. **Project Roads:** A road inside the boundaries of the zone of a development project of a public authority for the utilisation of means such as forests, irrigation, hydro-power, coal, sugarcane, etc. is known as a project road. Numerous developmental projects have been commenced due to which the expanse of project roads has increased from 1, 30,893 km in 1971 to 2, 70,523 km around 2000.

C. International Roadways

The roads which are funded by the World Bank and link India with the countries situated in the neighbouring regions are known as international highways. These highways can be categorised in this way:

(a) The main trunk routes connecting the capitals of neighbouring countries. Some of the important roads in this category are (i) the Lahore-Mandalay (Myanmar) route passing through Amritsar-Delhi-Agra-Kolkata-Golaghat-Imphal (ii) Agra-Gwalior-Hyderabad-Bangalore-Dhanushkodi road and (iii) Barhi-Kathmandu road.

(b) Routes linking key cities, ports etc. with arterial network such as: (i) Agra-Mumbai road (ii) Delhi-Multan road (iii) Bangalore-Chennai Road and (iv) Golaghat-Ledo road.

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4.2.3 Features, Facilities And Suitability Of Roadways

A physical road is of no bearing in itself, at least not keeping in mind freight transport viewpoint. Only when a road is being used for the purpose of transportation that it may be said to be of any importance. The role of the road in environment has commonly always been to enhance the value of a person, a service or a product. Roads enable and ease the process of transportation and increase logistical utility. More explicitly we can witness that in modern society, roads might play a more diverse and complex role. The role played by roads depend on the variety of structure and the context in which it appears.

One of the most significant roles of roads is to link to points or places. Those points happen to be the joining points in a multimodal transport system. As a result, it can be said that the value of roads shoots from both the existence of the system itself and the possibility of using it in the utmost valuable way. Roads are the main players in the area of welfare, letting economies of scope and scale to be utilised by the industry catering to customer needs.

The role of the infrastructure keeps changing with passing time. The traffic size, on a particular route may increase or decrease due to some reason thus changing the role of that particular road. An industry may be constructed or stopped, thus causing a change in traffic volume and composition. As cities grow roads may be constructed from a commuter road to a local road. An express highway may assume a less important role, as construction of other roads may start fulfilling the same transport needs. As the characteristics of the vehicles change the role of the road may also change.

Features of Roadways

Roadways play a very important role in a multimodal system. in order to understand this role and the various features of road transportation in a better way a descriptive model has been developed. This model can also be seen as the way ahead to fulfill the challenging transport policy goals. The basis for the model was laid in the work with so called Green Corridors (see Trafikverket, 2012 or Engström, 2013). The model was further developed in a paper to PIARC (Engström, Ingo, and Zarghampour, 2015). The five dimensions of the model are all pertinent to the three pillars of sustainability. The dimensions are reliant upon each other, and this is indicated by the arrows in the figure 4.1.

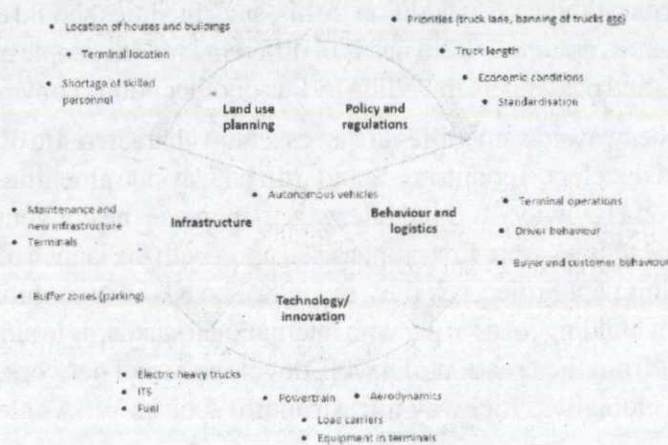


Fig. 4.1 Areas of importance for developing and understanding the transport system

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The given model in Figure 4.1 gives a fair picture of the basic features of road transport and the same may also be used to organise and enhance the comprehension of the role and features of roads in the freight and public transportation system. The figure also provides instances of areas that could be sorted as per the dimensions. Autonomous vehicles are an example that deal with all the dimensions which is why it has been included in the centre of the figure. Although the dimensions may be evaluated separately, it is essential to appreciate the interdependent relation to the other dimensions.

Technological improvements largely influence the designing and utilization of transport systems. Development is a constant activity which takes place in the industry, administration, and in the academic world. While, there may be some innovations capable of revolutionising freight/public transport system but generally most innovations establish small, progressive improvements.

The physical arrangement is essential to effectual transport solutions. Nowadays, digital infrastructure is gaining more and more importance as a supplement and/or an alternative for traditional infrastructure. It is the force behind effective conveyances and effective use of the physical infrastructure. In fact, digitalisation can be comprehended as the sixth mode of transportation since it is a method of distribution.

Facilities or Wayside Amenities and Suitability

India has seen a momentous upsurge in passenger and freight movement on National Highways. Roadways form the arterial network in the country to expedite trade and transportation of goods and people and they can be called the backbone of the country's economy. This is the reason why it has become important to offer people travelling by road not just the highest quality of road infrastructure but also sufficient places to unwind and take a break from highway journey.

Safety studies carried out in the world by organizations like the European Commission, National

Highway Traffic Safety Administration in the US and RoSPA in UK (Royal Society for Prevention of Accidents) have pointed to driver tiredness as one of the main reasons for crashes highway accidents. So, adequate conveniences are essential to take care of the requirements of highway commuters in a way which will encourage drivers to take breaks more frequently and bring down the number of accidents being caused due to driver-tiredness. In addition to this, such facilities should afford a better choice and numerous options to fulfil needs of different kinds of people using road like car/truck drivers and passengers travelling by bus or other public conveyance modes.

Worldwide, wayside amenities are an essential characteristic of the highway infrastructure in developed countries. Standardized wayside amenities are planned and developed on Highways at fixed intervals to increase the convenience of road travellers. These facilities were first emphasised upon with the launch of the National Highway Development Project (NHDP) in 1998. The NHDP was initiated with the main objective of building roads at par with international standards to aid smooth flow of traffic. Apart from the creation of a well-developed road network, NHDP also intended to develop allied highway infrastructure such as WSAs along National Highways.

Ministry of Road Transport and Highways has come up with a policy for developing standardized wayside amenities on National Highways at a gap of about 45 – 60 km on roads.

The primary objective of providing facilities to passengers and drivers travelling on road is to improve upon the convenience, on National Highways, by offering a standardized experience to them at selected locations. In addition, these wayside amenities provided to travellers facilitate better road safety by offering sufficient resting facilities for road commuters and thereby lessening chances of accidents.

Three types of facilities have been planned to cater to the needs of different sector of highway users for example, car, bus passengers and truck drivers:

1. Comprehensive facilities co-located for passengers and heavy vehicle drivers
2. Facilities meant only for passengers
3. Facilities meant only for truck drivers

The type of facilities necessary at any place is directed by the blend of traffic in a particular place.

Other than this, wayside amenities also give an opportunity to the road authorities to monetize the

profitable value of the land pockets possessed by them and avoid encroachment of these places due restricted vigilance.

Consolidation of Existing Facilities

Development of various wayside amenities was included in the scope of the highway development programmes, since the beginning of Build Operate Toll Model of road development in 2005, wayside amenities have been instituted by the highway authorities. These wayside amenities are normally setup in an area of about 4-5 acres and provide conveniences like petrol pump, eating joints, rooms or motels, washrooms etc. for both passengers and truck/lorry drivers. Despite best efforts, limited availability of land for setting up such facilities has stalled the development of wayside amenities on highways. Wayside amenities have also been instituted by state government agencies, PSUs and private organisations, in addition to the highway development authority. At many places highway retail outlets have been setup, these outlets are either cater to co-located amenities for passengers and drivers or they are devoted explicitly to truckers. BPCL outlets are an example of 'One-Stop-Truck-Shop', these are tactically placed on major highways to give transporters and their drivers a comfortable experience while on move. Apart from the petrol availability, these outlets provide facilities like dorms, place to wash clothes, parking, changing rooms and bathrooms to truckers free of cost or at nominal rates.

There are numerous private wayside amenities providers present throughout the length and breadth of the country but there is no organised base for such private providers. The wayside amenities setup by local providers vary extensively in size and range, going from small roadside small restaurants to big resorts.

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Check Your Progress

1. State the negotiability factor which differentiates roadways from railways.
2. Mention the connecting points of the North-South and East-West corridors.
3. Define project roads.
4. Where does the value of roads arises from?
5. Why are roadways called the backbone of an economy?

4.3 INNOVATIONS IN ROADWAYS TO MAKE IT LOGISTICS-FRIENDLY

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Since its inception, roadways has come a long way and there are many factors which have led to this fantastic transformation in this ever developing field. The success of the development of roadways goes to both the public as well as private sectors. Road development authorities have done a number of innovations and developments in the sector to make roadways logistics-friendly. Let's have a look at some of the measures adopted:

- **Improvement of roads and connecting bridges**

Adequate emphasis has been placed on construction and maintenance of roads in the country. Highway agencies have tried the many innovations that brought about positive changes in roadways making travel by road comfortable and safe. The use of cable-stayed bridge technology has been an innovative and new technology. It is a continuous girder-type structure which usually has one or two towers raised above the docks in the middle of the span. From these docks, cables are attached transversely to the girder to give additional support to the bridge. Such bridges offer greater stiffness and adjacent rigidity as compared to suspension bridges, making them more stable against wind.

States also were encouraged to investigate other evolving technologies that looked promising for building better, safer roads and bridges, ensuing benefits that have been dispersed across the country. Another innovative technology which has been more extensively adopted is segmental bridge construction. In this method, box girder spans, column supports and other bridge machineries are cast before assembly. As this work is carried in a distinct casting yard, construction of the bridge can carry on at the same time, resulting in speedy completion of the project with less disruption to people travelling by road and it also causes less harm to the environment.

Other high-performance bridge materials being used which are gaining popularity comprise fibres-reinforced polymer composites. These non-metallic mixtures, are made up of such fibres like glass, aramid and carbon, along with polymer resin matrixes, these amalgamations are comparatively more weather-damage resistant than steel. They are light in weight and can be handled and installed more easily, which results in speedy construction of bridges and roads.

Innovations have proved to be helpful in the maintenance of bridges also. For instance, epoxy-coated rebar is used to protect brick and mortar bridges from corrosion, this has empowered highway agencies to prolong the service life of bridges and decrease life-cycle costs.

- **Pavement design innovations**

The developments in bridge building technology have been supplemented by equally momentous innovations in pavement design. The Superpave system's binder and mix stipulations have given pavement designers equipment to give a customised design to a roadside pavement for the particular weather and traffic conditions at a specific sites. By utilising custom designing mixes, pavement engineers are able to create such

pavements which are able to withstand sufferings like permanent distortion and cracking due to extreme variations in temperature. Efficacy and features have been enhanced by the introduction of speedier testing techniques, for example use of the nuclear density device, which measures the in-place density mix sample and provides improved smoothness control.

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Equipment innovations have improved safety of travellers on road. For instance, concrete median barriers first came to be used in US in the 1940s and '50s to check speeding vehicles from crossing over highway centres into approaching traffic. Though there are numerous diverse concrete median barrier designs, the most extensively used is the New Jersey barrier. The barrier's tapering concrete shape is designed to minimalize harm to a vehicle by letting vehicle tires to ride up on the lower sloped face of the device, thus slowing it down and sending it back onto the highway.

A newer innovation that proving to save lives of people moving on highways is the use of shoulder rumble strips. These uninterrupted bands of raised material or depressions are indented into road shoulders to make those drivers aware who begin to drift off the road.

- **Better quality and environment**

Developments in apparatus and production and design practices have seen an equal match in greater stress on better quality. In recent past, more and more states have begun making use of a process called, constructability reviews, which helps in the improvement of their highway projects. As per this process, when a State is working on a highway project, the transportation agency and the contractor review the features of the project and try to find more ways to improve quality, substitute innovation and cut costs. These reviews are helpful in saving both time and money, but most significantly the outcome helps in less disruption to traffic moving on the roads. Value engineering is a comparable process where organisations and contractors can appraise proposed project designs and induce value-added changes that do not change the functionality of the original design or procedure.

Environmental analysis and safeguard also have grown in leaps and bounds. More and more environmentally friendly tools are being used which include pavers with pollution controls. Recycling is also being encouraged by highway agencies and the contractors have now started using recycled material like crushed concrete, reclaimed asphalt pavement and glass and brick as substitute aggregates in pavements.

Efforts and will to improve the environment have changed the way roads are designed and maintained today, more and more agencies are adopting a context-sensitive design approach that stresses upon the preservation of environmental, community, scenic and historic resources. Highway agencies have amplified their determination to lessen wetland losses caused by highway construction and maintenance activities. And apprehensions regarding soil erosion and sedimentation consequential to highway construction projects has led to the advance and use of enhanced erosion control devices, including such innovations as geotextile filter bags, which trap silt, and triangular silt barriers, which can be used to remove suspended soil particles from drainage water.

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The Future of Road Transport

The digital revolution has begun. Digitalisation, electrification, automation and the sharing economy are fast changing transport services. Innovation at the International Road Transport Union (IRU) offers innovative and novel services to the road transport sector, while proposing a global view to guarantee that industry comes together to work smarter. As the universal speech of transport, IRU works hand-in-hand with the private and start-up sectors as well as policy makers and examine, and find a way to innovation.

Advancements and use of innovative technology, like tools and apps to modernize, anticipate and enable change have brought about radical changes in the roadways industry. Along with that, there is always an ongoing effort to explore how innovation can affect broader issues of safety, sustainability and mobility, identifying important prospects for the accountable, intellectual and active development of goods and passenger transport.

Reduction in carbon emissions by goods transport

In 2015, IRU participated in a beginning to scrutinise the numerous types of vehicular requirements that would facilitate a greener future, and which has been proposed to be achieved by 2030. The resulting Commercial Vehicle of the Future report identifies the measures necessary to ensure efficiency gains across the transport chain, a reduction of carbon emissions and increased safety in road transport.

Building vehicles of the future

Hybrid-on-demand, adjustable roofs and new aerodynamic features are just few of the solutions EU project TRANSFORMERS is looking into when defining a truck of the future. The work also includes looking into vehicle automation.

Sharing best practices for electric taxis

Electrically driven automobiles are turning out to be a fascinating preference for taxi operations worldwide. Best practices, references, testimonials, as well as information on incentive schemes, training material and economic and environmental aspects are shared via IRU e-Taxi Initiative.

Making roads safer

While the prevention of accidents is dominant, IRU Projects look into the alleviation of the effect of road accidents. eCall (automated emergency call) is feature which has been devised to provide all pertinent information to emergency services. The work on increasing road safety is also diligently connected to the digitalisation of transport documents and is performed though I_HeERO project.

Connecting vehicles with infrastructure

In the times to come all vehicles, traffic lights, all other traffic users and tools will be connected to and share information with each other. This holds a promise of significantly improving competence and safety on the roads, while at the same time decreasing harmful environmental impact of road transport and can be achieved through CO-GISTICS projects.

Check Your Progress

6. State the technology which offers greater stiffness than suspension bridges.
7. Define value engineering.

4.4 FACTORS INFLUENCING CHOICE AND GROWTH AND SUITABILITY IN ROAD LOGISTICS

NOTES

In this section, we will deal with two types of factors crucial to road logistics: factors influencing choice and factors influencing growth. Let's begin our study with factors influencing choice.

4.4.1 Factors Influencing the Choice of Mode of Transport

There are innumerable modes of transport available to people to meet their ever-growing need for specific and most economic mode. In such a scenario, it is only important to select the best possible mode of transport particularly while working in a logistic company or transporting goods, for other purposes like travelling, which possibly have largest share in trips, also it becomes essential to decide between various modes available.

- **Accessibility** – This predominantly relates to the ease of getting, boarding a vehicle for transportation. If a mode cannot be accessed easily then it loses its practicality because of its unobtainability in some particular conditions or circumstances.
- **Cost of travel or service** – Taking into consideration the frequency of travel taking place for varied purposes and a modern capitalist economy, cost can be considered as the most important decisive factor. It can also be related to the financial capability of the user. This is one of the most dynamic factors as the readiness to pay alters based on the urgency or need to travel or transport.
- **Fuel efficiency/ carbon emission** – With environmental concerns on the rise and people becoming more aware of their responsibility towards improving the environment, many people and companies are preferring to opt for smaller carbon footprint. Some people even have a preference for electric vehicles merely because of the 'green' label related with them. Fuel efficiency is closely related to carbon emission while comparing, getting more output from same quantity of fuel is considered better hence always looked-for.
- **Speed** – This factor is yet another most essential determining factor based on the situation. Fastest mode of transportation is generally looked at as the best option but related cost makes it less worthwhile, on the other hand a cheap mode of transport may result in delay and the purpose of whole trip might get lost.
- **Goods or passenger carrying capacity** – This is another essential factor specifically for logistic companies, it becomes significant in case while travelling in groups. While going on a school trip, it will not be a good idea to travel in number of vehicles because of safety and security reasons and it will also not be convenient. Hence, in such a situation a vehicle with higher luggage and passenger carrying capacity will be favoured. In case of transportation of goods, the concept of scale of economies is best exploited for economic profit while dealing with bulk orders.
- **Intermodal integration** – For long trips over a long distance, change of mode of transport becomes the most significant factor for completion of the trip. In

case the chosen mode is not integrated with other modes then it will become almost impossible to complete the trip. In some cases, integration of modes comes at a heavy cost.

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- **Reliability of the vehicle/mode** – It is pertinent for the chosen mode of transport to be reliable. In case a vehicle develops some fault or is prone to be faulty, all other factors will be rendered useless. In case of an unreliable mode, result will be both loss of time and money. Reliability again gains importance based on the peculiarity of the situation.
- **Comfort** – The comfort factor in travel or transport industry is a personality oriented factor, as it is ignored by some while some give it the top most priority, depending upon their financial status. Comfort is considered to be essential while travelling and is generally ignored in case of transportation of goods. Humans travel for various purposes for instance work, leisure journey, picnic, shopping and thus always prefer comfort. Those who can afford to pay more are expected to get more comfort while some prioritize cost over comfort depending on their personal choice.
- **Safety** – Bearing in mind the increased number of accidents, safety is another very important factor to be considered. Anyone will wish to ensure maximum available safety for their loved ones. Even in case of logistics safety is of utmost importance especially while dealing with fragile material.
- **Privacy** – This factor is not given too much importance while travelling and comes to the fore only in special cases where the purpose of trip is confidential or pertaining to state security matters. Conversations or conduct during such journeys needs to be kept confidential. It can also be required when a person wishes to spend quality time with someone. Well, there is very little possibility of privacy while travelling by public means of transport, private vehicles on the other and can provide high level of privacy.
- **Frequency** – A mode with higher frequency, for example, metro rail, roadways buses or local trains, is desirable as the waiting time reduces thus saving time. Modes with good frequency help especially in cases of delays.

4.4.2 Factors Influencing Growth in Road Logistics

It is practically unthinkable in present day economy for an organisation to work without the help of transportation. Transportation is an indispensable and a foremost sub-function of logistics that generates time and place utility in goods. In effect, transportation management is the mainstay of the complete supply chain that makes it possible to accomplish the well-known seven Rs of logistics, i.e., the right product in the right quantity and the right condition, at the right place, at the right time, for the right customer at the right cost.

Understanding micro and macro logistics

Decisions related to transportation effect the other related functions, and there is a close connection between all. Therefore, decisions related to transportation cannot be made in isolation. This portion of the role of transportation in logistics can be called 'Micro Logistics,' where at the level of an organisation, the company optimizes this function for viable cost advantage.

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The significance of transportation should also be considered by assessing the impact of transportation on the economy of a country. Studies show that in India, the entire logistics cost constitutes around 10 per cent of the GNP out of which roughly 40 per cent is a result of transportation alone. In the U.S., the estimations display that the cost is around 6 per cent of the GNP. The main infrastructure essential for moving goods from place A to place B in India involves the dynamic role of Roads, Road Freight Industry, Railways, Ports and Shipping, and Pipelines, all of which are either controlled or measured by the government. The effective and operative management of this infrastructure to ensure the smooth flow of goods constitutes 'Macro Logistics.' Unfortunately, the situation in our country is such that due to unprincipled and immoral management of 'Macro Logistics,' the industries are not able to derive the best out of their 'Micro Logistics.'

Reasons for Growth of Road Network

Roads are the veins by means of which the economy of a country throbs. By linking producers to markets, workers to jobs, students to school, and the ailing to hospitals, roads play the vital role to any progress agenda. The organisation lends more for building roads than for working upon education, health, and social services pooled together. Nevertheless, though roads, along with goods and people, transport economic and social benefits, they can also come at some social costs for example, pollution, environmental degradation or deforestation. The Amazon rainforest contains nearly 100,000 km of roads—sufficient to circle the Earth two and a half times. And the transport sector accounts for about 23 per cent of global energy-related carbon dioxide emissions and a significant share of local particle pollution. Such trade-offs need to be weighed when planning any intervention.

Transportation contributes to the economic, industrial, social and cultural developments of a nation. The aim of economic activities is the method of satisfying the needs of any commodity, whether the production - distribution of products or the fulfilling the commodity demand.

The growth of road transportation infrastructure development in India can be attributed to following reasons:

A) Connectivity to villages and remote areas:

While there are other means of transportation available to the majority of population of India, the road transportation is the closest and most accessible for the general masses. The flourishing growth of a nation is not only dependent on the urban areas, but suitable transport facilities connecting the far flung villages to the nearest district headquarters, commercial and industrial centres are also important factors contributing to development of countries especially developing nations.

B) Plausible network density

Due to the geographical conditions of the country and major part having road construction friendly terrain, it has been possible to construct a dense road network in India touching almost every big and small village of the country. The road network laid out across the length and breadth of the country covers 33 lakh kms (including expressways, NH, SH, MDR, ODR and RR).

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C) Effect of Indian economy

The ever growing Indian economy has been a major cause of growth in the road logistics in India. The affordable transportation cost is an influencing factor on consumer cost for commodities. Reduced cost of transportation saves resources which results more production which in turn creates more demand, which is met majorly by road transportation.

D) Growth in freight and passenger traffic

The exponential growth of 15.4 per cent in road passenger traffic per annum in comparison to 9 per cent rail passenger traffic growth has contributed tremendously in growth of road logistics.

4.4.3 Suitability for Different Cargo and Distance Range Segments

The mode of transportation of cargo is dependent on the size, weight and distance that the merchandise ought to travel to reach its destination. Different modes are suitable for different kinds of cargo. To best understand the most suitable means of transportation we first need to comprehend different kinds of cargo.

Types of Cargo

Cargo is generally prearranged into many shipment categories before transportation. A particular merchandise's category is decided based on the following:

- The type of item being transported (for instance, a pressure cooker would fit into the category 'household goods')
- Size of the shipment (with respect to both, size and quantity)
- Time duration for delivery of merchandise/time in transit

Shipments are characteristically categorized as household items, express, parcel, and freight shipments. Furniture, art and other such items are included in the list of household goods.

Personal Merchandise

• Documents/Very Light Cargo

Very small business or personal items for instance envelopes or documents are considered overnight express or express letter shipments. These shipments are generally ever more than a few kilograms in weight and almost always travel in the carrier's own packaging. Express shipments nearly all the time travel some distance by air. A document may travel coast to coast in the United States instantaneously or it may take a number of days in transit, this depends upon the service options and costs selected by the shipper.

• Boxes/Slightly Larger Items

Larger things for instance small boxes are taken as parcels or ground shipments. These shipments do not generally cross over 50 kg (110 lb), with not even one piece of the shipment weighing more than about 70 kg (154 lb). Parcel cargo is always boxed, at times in the shipper's packaging and at times the packaging is provided by the carrier.

Service levels are again inconstant but generally all ground shipments traverse a distance of about 800 to 1,100 km (497 to 684 mi) per day. Based on the origin of the package, it may travel from coast to coast in the United States in about four days. Parcel shipments are generally not conveyed by air, they normally move by road or rail.

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Freight Shipment

• Less-than-truckload Freight

Less than truckload (LTL) cargo is the first category of freight shipment, which characterizes most of freight shipments and almost all business-to-business (B2B) shipments. LTL shipments are also mostly called motor freight and the shippers conveying them are called motor carriers.

LTL shipments range from 50 to 7,000 kg (110 to 15,430 lb), being less than 2.5 to 8.5 m (8 ft 2.4 in to 27 ft 10.6 in) most of the times. The average single piece of LTL freight is 600 kg (1,323 lb) and the size of a standard pallet. Long freight and/or large freight are subject to extreme length and cubic capacity surcharges.

Carriers used in LTL may vary between 28 and 53 ft (8.53 to 16.15 m). The standard for delivering freight within the city is usually 48 ft (14.63 m). 28 ft (8.53 m) trailers are used in congested and residential areas.

The shipments are usually palletized, stretch [shrink]-wrapped and packaged for a mixed-freight environment. Different from express or parcel consignments, LTL shippers must provide their own packaging, as carriers do not provide any packaging supplies or assistance. However, crating or other substantial packaging may be the need of the hour.

• Full Truckload Freight

In India the permissible FTL weight is dependent on the kind of vehicle carrying that load. The Ministry of Road Transport and Highways, Government of India has notified these specifications in Notification of Specification of Maximum Gross Vehicle Weight and the Maximum Safe Axle Weight. In America, shipments larger than about 7,000 kg (15,432 lb) are characteristically classified as Full Truckload Freight (FTL). This is so as it is more efficient and reasonable for a large shipment to have exclusive use of one larger trailer rather than split space on a smaller LTL trailer.

While express, parcel and LTL shipments are intermingled every time with other shipments on one carrier and are characteristically reloaded on to many vehicles during their transport, FTL shipments travel as the only shipment on a trailer till they reach their destination. In fact, FTL shipments usually deliver on exactly the same trailer as they are picked up on.

Check Your Progress

8. State the most dynamic factor of choice of mode of transport.
9. What are the seven Rs of logistics?
10. Which type of freight shipments are called motor freight?

4.5 INNOVATIVE SCHEMES/FACILITIES TO POPULARIZE ROAD LOGISTICS IN INDIA

The objective of smart cities has driven the Government of India towards paying attention towards issues pertaining to road engineering, signage, vehicle design, education of road users and enforcement of traffic safety services. Regardless of controls and

commands, the Central and State Governments have a combined responsibility in improving upon the incidence of road accidents and fatalities.

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India has the second largest road network in the world which spans the distance of 5.4 million km. This road network transports more than 60 per cent of all goods in the country and 85 per cent of total passenger traffic moving in India. There has been a gradual increase in road transportation in the recent years due to the development in connectivity between cities, towns and villages in the nation.

In India automobile sales and freight movement by road is increasing at a rapid rate. Conscious of the necessity to make a worthy road network to cater to the increased traffic and movement of goods, Government of India had earmarked 20 per cent of the investment of US$ 1 trillion reserved for infrastructure during the 12th Five-Year Plan (2012–17) to develop the country's roads. Under the Pradhan Mantri Gram Sadak Yojana (PMGSY), 133-km roads per day in 2016-17 were constructed as against a 2011-14 average of 73-km per day.

Key Investments/Developments

It has been stated by the Road Development Ministry that the Government aims to increase corporate investment in roads and shipping sector, along with introduction of business-friendly policies that will equalize profitability with operational project execution. Some of the main investments and developments in the Indian roads sector are as follows:

- The National Highways and Infrastructure Development Corporation (NHIDCL) has been entrusted upon with the contract to build five all-weather access tunnels costing ₹ 23,000 crore (US$ 3.57 billion) in Jammu and Kashmir by 2024.
- Abertis Infraestructuras SA, a Spanish infrastructure firm, has settled to buy two toll road assets in operation in South India from Macquarie Group for ₹ 1,000 crore (US$ 150 million) to boost its presence in India.
- In the Union Budget 2017-18, the Government of India has allocated ₹ 64,000 crore (US$ 9.55 billion) to NHAI for roads and highways and ₹ 27,000 crore (US$ 4.03 billion) for PMGSY.
- Road projects worth ₹ 34,000 crore (US$ 5.32 billion) are being commenced by the central government to reduce traffic on the road network linking the National Capital Territory of Delhi.
- The Ministry of Road Transport and Highways, Government of India, invested ₹ 14,916 crore (US$ 2.32 billion) for the Special Accelerated Road Development Programme for North East (SARDP-NE) and ₹ 4,095 crore (US$ 635.6 million) for the National Highway (Original) over the past two years to improve the road infrastructure in India's north eastern region.
- The Cabinet Committee on Economic Affairs, Government of India, has approved the development of 19 kms long four laning from Pandoh Bypass end to Takoli section of National Highway (NH) -21 in Himachal Pradesh, which is estimated to cost ₹ 2,775.93 crore (US$ 430.27 million).
- The Road Transport and Highways Ministry has invested around ₹ 3.17 trillion (US$ 47.55 billion), while the Shipping Ministry has invested around ₹ 80,000 crore (US$ 12.0 billion) in the past two and a half years for building world class highways and shipping infrastructure in the country.

4.5.1 Share of Roadways in Cargo Movement in India and Worldwide

Railways and roadways control the multi-mode transport system in India. Both these modes with one another account for a large portion of the passenger and cargo movement. The other modes of transport, for example, inland water transport, shipping, airways, pipelines, ropeways, etc. have an insignificant share in this field. Numerous studies carried out so far indicate that the share of passenger and cargo between road and rail transport has changed, as a matter of fact the share has been reversed in favour of road transport gradually since India's independence in 1947. Consequently, demonstrating the appearance of road transport as the primary mode of transportation and the trend in favour of the road is surely on the rise. Whereas the railways, airways, shipping, etc. because of their central ownership and managerial set-up have a statistical system for generating data, the carriage of goods by road transport is marked by a poorly maintained database. The reason being that transportation of goods by road is primarily controlled by the private sector, lakhs of micro-truck operators dominate this field. These petty transport operators generally do not have the wherewithal to maintain road transport statistics partially because of limited resources, limited understanding of the Motor Vehicles Act, fear of income-tax, etc. and partly because they do not want to part with the information available with them.

Many freight delivery firms, carry all kinds of cargo by road. Transporting all things from letters to household things, to cargo containers, these firms provide fast, sometimes same-day, delivery. Foodstuffs is a good example of cargo ferried by road, as stores and supermarkets need daily to replenishments for the goods kept in their stores. All kinds of dealers and manufacturers of bank upon road transport for delivery of their products, be it FTL, LTL or smaller delivery vans. The smaller road haulage companies continuously endeavour for the best routes and prices to ship out their products. Undeniably, the level of commercial cargo conveyed by less significant business houses serves as a perfect measuring yardstick of healthy economic development. As these kinds of vehicles travel and carry literally anything, including couriers transporting parcel and mail.

Even though National Highways in India make up for only around 2 per cent of the entire road network, yet 40 per cent of the total road traffic moves on these roads. Easy availability, adaptability to individual needs and cost savings are some of the factors which go in favour of road transport. Road transport also acts as a feeder service to railway, shipping and air traffic. The figure of vehicular movement on Indian roads has been escalating at an average pace of around 10 per cent per annum. The share of road traffic in the entire traffic had moved up from 13.8 per cent of freight traffic and 15.4 per cent of passenger traffic in 1950-51 to an approximated 62.9 per cent of freight traffic and 90.2 per cent of passenger traffic by the end of 2009-10. The fast growth and consolidation of the road network, thus, is vital, to provide for both present and future traffic and for improved accessibility to the hinterland. Furthermore, there is a need to regulate, road transport for improved energy efficiency; less pollution and greater road safety. The Ministry also identifies the need for improving the aspect of safety on India's roads.

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Worldwide Share of Roadways in Cargo Movement

The share of EU road freight transportation by road (74.9 per cent) was more than four times as high as the share by rail transportation (18.4 per cent), while the remaining (6.7 per cent) of the freight transportation occurring in the in 2014 was carried along inland waterways. Compared with the modal split in 2009, the share of inland freight carried by roads was 2.2 percentage points lower in 2014, whereas the share conveyed by inland waterways had gone up by 0.7 percentage points and that by rail transportation by 1.5 percentage points.

Compared to the size of population, road freight transport was maximum among the EU Member States in Luxembourg, where, at an average, 15.5 thousand tonne-kilometres of cargo was transported by road for each inhabitant in 2015; this has been seen as 70 per cent higher than the next highest level of road freight transport per inhabitant, recorded in Lithuania (9.1 thousand tonne-kilometres). In both circumstances, the large majority of the cargo transported by road was international movements performed by vehicles registered in these two EU member states.

The division between national and international road freight differed significantly across the EU Member States: the maximum extents of national road cargo movement in 2015 were recorded in Cyprus (97.3 per cent) and the United Kingdom (95.5 per cent), while shares in France and Sweden were also more than 90 per cent. Opposed to that, in 2015, half of the Member States stated that foreign road networks made up for most of the goods conveyed by vehicles registered in their Member State. The share of international road cargo transport in total road cargo was mainly high in Latvia (81.3 per cent), Slovakia (84.4 per cent), Luxembourg (87.5 per cent), Slovenia (88.4 per cent), and Lithuania (89.0 per cent).

All national cargo transport within Cyprus and Malta has been road because of absence of any railways or inland waterway arrangement. In another places, road transport made up for more than 90 per cent of national cargo transport in Ireland, Greece and Spain in 2014. Opposed to this, road transport accounted for only one fifth of the national cargo transported in Latvia (18.8 per cent), with the balance (81.2 per cent) conveyed by rail. More than half of the domestic cargo transported in the other two Baltic Member States — Estonia and Lithuania — was also ferried by rail in 2014. Close to one tenth (9.9 per cent) of entire domestic cargo in Germany was conveyed on inland waterways in 2014, with this share higher in Belgium (16.0 per cent), Bulgaria (26.9 per cent) and Romania (29.0 per cent) as well as in the Netherlands where it peaked at 46.6 per cent.

Domestic cargo transportation grew at a slower pace in the EU than constant price gross domestic product (GDP) between the period 2004–2014; as the ratio of these two values was 9.4 per cent lower in 2014 than in 2004.Equating with the situation in 2004, Bulgaria, Slovenia and Hungary documented the highest upsurges in domestic cargo transportation comparative to GDP, with their respective tables more than 40 per cent higher in 2014 than 10 years earlier. The rate of change in domestic cargo transportation was about one third higher than the total growth in economic activity between 2004 and 2014 in Poland and Lithuania. By contrast, the ratio of inland freight transport to GDP fell at a speedy pace from 2004 to 2014 in Cyprus, Ireland and Estonia, in each case down by more than 50 per cent.

Check Your Progress

11. What are the issues which have gathered the attention of Government of India through the objective of smart cities?
12. Why does the level of commercial cargo conveyed by less significant business houses serve as a perfect measuring yardstick of healthy economic development?

4.6 SUMMARY

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Some of the important concepts discussed in this unit are:

- Road transport actually refers to transportation of goods and people from a place to another via roads. Road is a course joining two or more destinations, which has been either surfaced or made suitable to allow movement of motorised and non-motorised vehicles.
- Roads have been existent in India for around 5000 years. In early Indian history efforts were made by Ashoka and Chandragupta for constructing roads. But the actual development of roads happened during the Mughal period.
- Roads play a very important role in the development of a nation's economy: it offers transportation of goods and passengers for short and medium travels, is easy and cheap to construct and maintain, offers far higher negotiability, is one of the main feeders to railways, is extremely essential for the industrial development of a country and also responsible for generating employment in the country.
- Roads in India have been classified into different categories on the basis of their functionality or by due to their primary or complementary roles.
- The primary classifications of roads are: (i) National Highways (ii) State Highways (iii) District Roads and (iv) Village Roads. The secondary classification of roads includes: Border Roads, Urban Roads and Project Roads. And the third categorization of roads are international roadways.
- One of the most significant roles of roads is to link to points or places. Those points happen to be the joining points in a multimodal transport system. As a result, it can be said that the value of roads shoots from both the existence of the system itself and the possibility of using it in the utmost valuable way. Roads are the main players in the area of welfare, letting economies of scope and scale to be utilised by the industry catering to customer needs.
- The primary objective of providing facilities to passengers and drivers travelling on road is to improve upon the convenience, on National Highways, by offering a standardized experience to them at selected locations. In addition, these wayside amenities provided to travellers facilitate better road safety by offering sufficient resting facilities for road commuters and thereby lessening chances of accidents.
- Road development authorities have done a number of innovations and developments in the sector to make roadways logistics-friendly: improvement of roads and connecting bridges, pavement design innovations and better quality and environment.
- The digital revolution has begun. Digitalisation, electrification, automation and the sharing economy are fast changing transport services. Innovation at the International Road Transport Union (IRU) offers innovative and novel services to the road transport sector, while proposing a global view to guarantee that industry comes together to work smarter.
- Factors influencing the choice of mode of transport include: accessibility, cost of travel or service, fuel efficiency/ carbon emission, goods or passenger carrying

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capacity, reliability of the vehicle/mode, intermodal integration, privacy, safety etc.

- The growth of road transportation infrastructure development in India can be attributed to following reasons: connectivity to villages and remote areas, plausible network density, effect of Indian economy, and growth in freight and passenger traffic.
- Cargo is generally prearranged into many shipment categories before transportation. A particular merchandise's category is decided based on the following: The type of item being transported, size of the shipment and time duration for delivery of merchandise/time in transit.
- Shipments are characteristically categorized as household items, express, parcel, and freight shipments. Personal merchandise are categorized as Documents/ Very Light Cargo and Boxes/Slightly Larger Items. Freight Shipment are categorised as Less-than-truckload Freight and Full Truckload Freight.
- India has the second largest road network in the world which spans the distance of 5.4 million km. Under the Pradhan Mantri Gram Sadak Yojana (PMGSY), 133-km roads per day in 2016-17 were constructed as against a 2011-14 average of 73-km per day. It has been stated by the Road Development Ministry that the Government aims to increase corporate investment in roads and shipping sector, along with introduction of business-friendly policies that will equalize profitability with operational project execution.

4.7 ANSWERS TO 'CHECK YOUR PROGRESS'

1. The negotiability factor which differentiates roads from railways is that railways offer far higher negotiability in terms of gradients and turns which railways is unable to provide. It is because of this trait that roads can also be built in hilly terrains.
2. The North-South and East-West corridors (7,300 km) links Srinagar in the North to Kanyakumari in the South and Silchar in the East to Porbandar in the West.
3. A road inside the boundaries of the zone of a development project of a public authority for the utilisation of means such as forests, irrigation, hydro-power, coal, sugarcane, etc. is known as a project road.
4. The value of roads arises from both the existence of the system itself and the possibility of using it in the utmost valuable way.
5. Roadways form the arterial network in the country to expedite trade and transportation of goods and people and this is why they can be called the backbone of the country's economy.
6. The use of cable-stayed bridge technology has been an innovative and new technology which offers greater stiffness than suspension bridges.
7. Value engineering is a comparable process where organisations and contractors can appraise proposed project designs and induce value-added changes that do not change the functionality of the original design or procedure.

8. Cost of travel or service is one of the most dynamic factors of choice of mode of transport as the readiness to pay alters based on the urgency or need to travel or transport.
9. The well-known seven Rs of logistics refers to the right product in the right quantity and the right condition, at the right place, at the right time, for the right customer at the right cost.
10. Less-than-truckload freight is the type of freight shipment called motor freight.
11. The objective of smart cities has driven the Government of India towards paying attention towards issues pertaining to road engineering, signage, vehicle design, education of road users and enforcement of traffic safety services.
12. The level of commercial cargo conveyed by less significant business houses serves as a perfect measuring yardstick of healthy economic development as these kinds of vehicles travel and carry literally anything, including couriers transporting parcel and mail.

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4.8 QUESTIONS AND EXERCISES

Short-Answer Questions

1. What is the significance of roadways?
2. Write a short note on the growth of road transportation infrastructure development in India.
3. Explain the suitability of roadways.
4. Write a short note on the innovative schemes/facilities that have been taken to popularize road logistics in India.
5. Briefly explain the share of roadways in cargo movement in India and worldwide.

Long-Answer Questions

1. Discuss the classification of roads into primary modes of transport.
2. Examine the categorization of roads into complementary mode of transport.
3. Explain the features and facilities of roadways.
4. Describe the innovations in roadways to make it logistics-friendly.
5. Describe the factors affecting the choice of mode of transport.

UNIT 5 ROADWAYS AND LOGISTICS ECONOMICS

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Structure

5.0 INTRODUCTION

Water has been known to be one of the most primitive forms of freight transportation. Water being the basic ingredient, mandatory for human survival, most of the earlier settlements used to be built along or at seacoasts and passable inland waterways. With the growth and development of these settlements, roads began to be built for transportation of freight to and from the navigable watercourses. This is how the inland points of cargo pickup came to be connected to the delivery points which were non-approachable by waterways. Transportation of cargo by ships has a very limited nature. No can be transported to its destination exclusively by way of ship.

Typically, goods being brought into ports by water have to be unloaded and shifted to another mode of transportation for delivery to their destination i.e. by way of road transport like truck/lorry or by means of railways through rail wagons, since rail wagons cannot reach all places so, for ultimate disposal of items to their final destination, road is the only means of transportation. With passing time, road and train networks which were once used to carry freight from coasts or waterway ports to their ultimate destination, greatly expanded making freight transportation from port to port overland more efficient and more affordable than the marine transportation of freight.

5.1 UNIT OBJECTIVES

After going through this unit, you will be able to:

- Discuss the roadways freight rate and its determinants
- Describe the concept of freight levels and road cargo elasticity
- Explain the concept of owning a fleet, its maintenance, scheduling and outsourcing

- Examine the concept of logistics in roadways
- Identify the role of national highways and toll highways
- Discuss the technological advancements in roadways

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5.2 ROADWAYS FREIGHT RATE DETERMINANTS

The charge for transporting goods is called freight rate. This is a reflection of a variety of factors other than average transportation charges. The main determinants of freight rate are:

- selection of means of transportation (road, sea, train, air),
- weight and size of the consignment,
- distance to be traversed,
- points of pickup and delivery, and
- nature of goods being transported.

All the aforementioned factors play their own part in determining the transportation freight rate, nevertheless they are also all connected to each other. While determining the mode of transportation to be used for delivery of freight to its destination, numerous things ought to be considered which have an incidental effect on the freight.

Central and state authorities all have their own rules and guidelines with respect the size, weight, and sort of freight to be transported by road. Generally, the more freight an individual or company transports, the cheaper it turns out to be. This is a significant element while calculating freight rate to be charged to people or companies by shipping companies. In the present times, many businesses/companies are working with the single purpose of making freight transportation cheaper and simpler for small businesses and individuals desirous of moving freight.



Consolidator: An organization or an individual who puts together shipments from various companies into one single shipment.

The freight rate is not only dependent on the nature of the material being transported but also some external factors which are as follows:

- **Consolidator:** An organisation or an individual who puts together shipments from various companies into one single shipment.
- **Customs Broker:** An individual or an organisation, who under a license given by the state authorities, engages in entering and clearing goods through Customs.
- **Freight Forwarder:** An individual whose works as an agent on behalf of the shipper to organise shipping services. A freight forwarder often makes the booking reservation.



Customs broker: An individual or an organization, who under a license given by the state authorities, engages in entering and clearing goods through Customs.

Consolidators, customs brokers, freight forwarders, etc., can be important factors in determination of freight rate because of their skill, business relationships, and the size of their operations. These factors are of assistance in keeping the freight rate low for small businesses or people in need of transporting their goods.



Freight forwarder: An individual whose works as an agent on behalf of the shipper to organize shipping services. A freight forwarder often makes the booking reservation.

In the commercial road transportation industry, many transporters tender loads to freight brokers who are entrusted with the job of finding capable carriers for transportation of freight at a suitable price for all involved in the movement. Brokers

have the know-how of technical implements to help determine the most reasonable and effective way to move cargo.

Tracking of Freight Rates

The current road freight industry, is controlled by small provincial operators, which makes freight rates very volatile. The current market is largely effected by issues like supply demand of vehicles, seasonal changes, fuel price rise, off-loading shipments etc. The main gap in the prevailing system is the absence of complete information related to freight rates and the availability of freight trucks on particular routes (route density) etc. It is thus not easy to forecast the continuing trend in freight rates, the emergent trend in truck availability for a said period and, to evaluate the freight rates. Freight rates for the same routes on different dates may therefore either not be available or differ largely, thus hindering the scrutiny of freight rates and movement of shipment at regional and national level as well. Inadequacy of such all-inclusive data often causes wide instabilities of freight rates which in turn leads to non-optimization of the freight space. The transportation industry in our country is extremely fragmented because of which it is not possible to study, predict and compare freight rates so easily.

No organised researches have been done on freight rate structure and there are no databanks existing on the rates and volume of merchandise conveyed through different routes. The Road Freight Index (RFI), is the first of its kind enterprise by Transport Corporation of India, initiated in the year 1998. Transport Corporation of India, was the pioneer in the Supply chain solutions Industry, it started providing this service to bring in standards, best practices and regulation into this sector in our country, keeping global practices as the foundation of their endeavours. The Road Freight Index (RFI) is an index of weighted average freight rates accumulated through numerous routes, quite like to a stock market index.

The **Road Freight Index** (RFI) is an instrument, which helps in making an all-inclusive analysis of freight trends, according to the route and date and helps in forecasting the freight trends and freight rates for the near future.

Determinants of Freight Rates in India

- **Cost of merchandise:** Freight rates have a huge effect on the cost of goods being transported from a place to another. Importers and exporters must be well aware of these determining factors which influence freight rates in our country in order to formulate a better business plans. It is also important to understand that freight rates are controlled by a certain organization that guarantees every freight forwarded charges only as per norm. However, there could be minor deviancies which can be well explained by freight forwarders. Importers and exports may require freight quotes in order to evaluate the all-inclusive cost of every shipment.
- **Fuel charge:** Fuel cost is the main determinants in deciding freight rates. In order to transport merchandises from one place to another, vehicles need to be filled with fuel. Sadly, due to high and frequent fluctuations in fuel costs, it has become extremely difficult to determine prospect freight rates. Freight forwarders have to cover the expenditure on fuel and the maintenance of their vehicles. In addition, their charges should also envelop the salary of all employees of the company.

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Road freight index (RFI): It is an instrument, which helps in making an all-inclusive analysis of freight trends, according to the route and date and helps in forecasting the freight trends and freight rates for the near future.

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- **Weight of merchandise:** The weight of the commodities being transported is one more main determinants of the freight charges. Goods being transported are always weighed before discharge so that accurate freight cost can be calculated. This is done by the freight companies to ensure that the weight of the merchandise being transported has exceeded the prescribed limit. Trucks, ships and airplanes have a maximum carriage capacity which they are bound to strictly follow for safety reasons crossing their prescribed limits may prove to be hazardous for them as well as the merchandise. However, in certain cases excessive baggage is allowed at higher charges.
- **Size of merchandise:** The size of the cargo also determines rates liable to be paid by consignors. Certain things, being bulky, may require more space to be carried hence some freight forwarding companies take size into consideration while calculating freight rates. If a particular cargo surpasses the maximum size, the consumer may be asked to divide it into sections by the transporter. As a result of which the sender will have to pay for two separate packages.
- **Distance to be covered:** The distance from the start point to the destination is another vital determinant. Freight forwarding companies determine the cost of transporting consignments from one place to another and use the distance as basis for their transportation charges. Logically, packages to be delivered to farther destinations will require more time, energy and fuel. Accordingly, their freight transportation charges will be higher. Sometimes, short distance cargo deliveries also quite a lot because of less load in the vehicle carrying that cargo. Freight rates in India may vary due to various conditions.
- **Delivery time:** The time of delivery is another factor to be taken into consideration while calculating the freight rate being charged. Express deliveries which require to be shipped immediately often cost more than the ones which are sent out at normal time.

5.2.1 Freight Levels And Road-Cargo Elasticity

A modification in the road freight transport price, especially in the longer run, may have varied effects on road freight transportation. These effects are generally expressed in the form of elasticities. The idea of elasticities is originally known to the brainchild of English economist, Alfred Marshall. Elasticities provide the ratio of a percentage variation in demand or supply (like, road tonne kilometres) to a percentage variation in one of the factors elucidating demand or supply (for example, road freight transportation charge). The benefit of elasticities is that they do not have any dimensions, to say that, a variation in the unit of dimension (for instance from kilometres to miles) does not have an effect on the elasticities. Since the days of Marshall, numerous demand and supply models have been projected, either with constant elasticities (double logarithmic specification) or from which inferred elasticities at certain points (for example, at average values) can be determined.

Difference in Elasticity Values

Often, sizeable amount of variety in elasticity values has been seen. This heterogeneity can be explained on the following basis:

1. Different elasticities appear to be referring to one thing, but are often consider different response mechanisms, that may be acting at diverse time scales. This concept will be discussed further in this section.
2. There can be a variation in price elasticities because they refer to the following:
   a. Different segments of the market e.g. commodity sections, distance sections, geographic markets, etc., with diverse substitution prospects: for example, if two types of merchandises are close substitutes, the cross-price elasticity may be estimated to go high and the own-price elasticity will also be higher.
   b. Different constituents of entire transport costs, for example, toll charge, fuel charge or fixed transport charges: a comparative price modification that denotes a greater constituent of total charges can be estimated to create a greater effect.
   c. Price upsurges vs declines; as per the theory of prospect, deciding heads show stronger reaction to losses than to gains, so elasticities for price upsurges could be larger than for price declines.
   d. Different magnitude in price changes: if the slope of the reverse demand function dips with increase in the price, in such a situation large rate changes will give way to smaller elasticities in comparison to small price changes.
   e. Different characterisations of a transport mode (for example, trip mode versus main mode of a transport chain).

Moreover, special cross-elasticities (for example, effect of road transport rates on demand of rail) can be very different depending upon the shares of the modes on the market in base condition. This also suggests that cross-elasticities are not actually transportable from one nation to another in case of these countries having different mode shares.

Different Response Mechanisms

Freight transportation demand can be evaluated in terms of tonne kilometres (tkm), vehicle- kilometres (vkm) and vehicle-kilometres (and tonne kilometres) by mode (e.g. road vkm). The quantities of tonnes and tkm are concluded mostly by international and intra-regional patterns of trade which are mostly dependant on demand of consumer and the economic structure. The expanse of vkm is also reliant on logistics choices, such as on consignment size and the use of consolidation centres.

The following response mechanisms can be separated for the effect of a change in the price of road transport on road transport demand:

1. Using more energy-efficient load bearing vehicles
2. Change in style of driving to bring out the best fuel efficiency of a vehicle
3. Optimization of distribution of vehicles to shipments
4. Changing in the number and site of depots, with consolidation and distribution centres
5. Making an increase in the size of the shipment
6. Consolidation of shipments being initiated from the same company

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7. Consolidation of shipments being initiated from numerous companies.
8. Catering for more loads on return to decrease empty driving
9. Keeping in mind the locations of the consignor and consignee, planning the route in a more efficient way taking fewer detours
10. Changing the mode of transportation and using trans-modal means
11. Variations in production technology, making goods more transport and delivery friendly, without effecting the quality of the product
12. Decreasing kilometres per tonne by reviewing the production volumes per location
13. Decreasing kilometres per tonne by reviewing the choice of supplier and receiver
14. Reduction in demand for the product

By differentiating between various dependent and independent variables and response mechanisms, a sizable portion of the discrepancy in price elasticity values for road transport can be described. But then, a large quantity of variation remains undescribed, that is not only related to the differences between commodity groups, distance class and study areas, but also with the quality of the fundamental data and the research methods and supporting assumptions used.

5.3 CARRIAGE BY FLEET

In this section, we will learn about the concepts related to 'owning a fleet'.

5.3.1 Own Fleet: Capacity Counters, Maintenance, Scheduling, Freight Consolidation, Return and Reverse Logistics in Road Logistics

What is a fleet?

A fleet is a group of motorised vehicles owned or leased by a corporate, government or non-government agency or any other association not for personal but commercial use. Vehicles used by car rental firms, taxi firms, public utilities, cargo transport companies, and police departments are some examples of fleets.

Advantages and Disadvantages of Owning a Delivery Fleet

Based on the type of industry, possessing and working a delivery fleet can be important to the growth and expansion of a company. There are substantial advantages and disadvantages of owning a delivery fleet to supplement company shipments, and we've mapped out the most crucial in each category:

Advantages

- Owning a fleet permits flexibility to the business owners to shape their delivery schedule in order to put up with customers' requests.
- Own fleet of vehicles can be used for the purpose of wide advertisement, by posting posters and paintings on the vehicles without any extra charge, for companies providing delivery services, this method of advertising definitely proves to be beneficial.

Check Your Progress

1. State the external factors which affect the freight rate.
2. What is the road freight index?
3. Mention the benefit of the concept of elasticities.

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- For businesses working with time constraint, e.g., bakeries or flower delivery shops, owning a fleet may prove to be more efficient as they will not have to depend on an external service to deliver their fresh merchandises on time.
- Having a fleet of one's own provides the customers a more personalized experience while handing over products by the employee of the company rather than a courier boy.
- A company can buy a tracking enabled fleet with the help of which it becomes very easy for them to manage and track vehicles in the field and last minute changes in routes based on customers' request or due to traffic congestion.

Disadvantages

- Owning a fleet of vehicles can hugely weigh down a company in monetary terms.
- Buying right kind of insurance plans for a fleet of vehicles is an absolute necessity but the task in itself is a herculean task. This can been a long drawn and expensive procedure.
- A company planning to own a delivery fleet has to budget for vehicle mechanical and cosmetic maintenance.
- Parking a fleet of delivery vehicles is an issue too. To avoid this issue, some companies send their vehicles with the employees to their homes due to a lack of parking space and thus have to bear the cost of addition wear and tear.

Vehicle Capacity Counters

Vehicle capacity counters are an excellent tool to record ever move made by the vehicle. Besides, the intake relevant counter reading record for vehicles can be used to log the number of kilometres travelled by or the hours of operation of the vehicles. Counter readings indicate the consumption of fuel thus indicating its efficiency. Maintaining a record of the intake relevant counter reading is part of the Fleet Management.

Fleet Maintenance

Commercial vehicles have to be on the road perpetually. All said and done, there is hardly any respite for these vehicles as within no time of their docking, they are back on the road. That's why it is essential to make and follow an effective fleet maintenance plan to ensure that all vehicles being used stay serviceable.

A beneficial maintenance schedule is essential in minimizing lost time. A good programme guarantees that whenever a driver takes a vehicle out, that vehicle has undergone the essential overhauling. A classic maintenance schedule will include 1, 2 and 3 types of services. The 1 type of service is the most common type which covers maximum main parts of the vehicle. To say, tyres, transmission, brakes, clutch, etc. 2 and 3 types of services add more parts to these, with 2 type characteristically includes oil and grease change for smoother gear change and 3 type includes checking of the axils.

Each of these services should be carried out at definite mileage intervals. A typical service schedule might specify a type 1 service every 3,000 miles, a type 2

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every 6,000 and a type 3 as and when required. Suspension part of the vehicle should be examined every 12,000 miles but keeping in view different requirements of different vehicles, it is important to go by the instructions given in the manual. Over and above this, fleet vehicles should be cleaned up regularly and should be subject to a compulsory pre-trip checklist and service before they go out on the field.

Pre-trip checklist

The pre-trip checklist is important to guarantee that drivers take on journey safe vehicles. A suggested pre-trip checklist can be as follows:

- Checking the tyre pressure and
- Checking wheel nuts
- Ensuring the tyre tread wear is not uneven
- Ensuring adequate tyre pressure in all tyres
- Ensuring all hoses of the vehicle are inspected
- Checking brake functionality
- Updating log maintenance book

Fleet maintenance is a practice that proves to be very beneficial if done right, but this requires a lot of commitment and sincerity. One mistake can result in a failed inspection, or perhaps an accident, causing some fatality.

Fleet Scheduling

Freight units are the beginning of the optimization process. They drive fulfilling the demand and complete the optimization process. These units define, what needs to be transported, from which place to which place and when. The job of the optimizing agency or individual is to match these freight units with the available capacity. Capacity could be the company's own fleet or that of the freight carrier company. Trucks and trailers are one kind of capacity. Schedules and freight-bookings are the other kind. Where the optimizer has to route and schedule the vehicles, the schedules already have some routing prescribed, i.e., the order of locations and dates to be followed. The optimizer assigns the freight units to the schedule.

With that information of freight units as demands and the various kinds of capacities the optimizer comes up with a transportation plan. An optimizer schedules the movement of a fleet keeping the following in mind:

- **Selection of the best possible route**

Using the prevalent cloud technology and modern devices, optimizers can now lay their hands on real-time scheduling and route organisation data. The present status of a driver or vehicle is at their disposal, which lets the optimizer make changes moment-to-moment. Even at peak rush hours, it is easy to choose the most optimal route. GPS technology gives advanced geo-location, 3D mapping and telematics that let optimizer plan the fleet's journeys to save fuel, reduce wear and tear and process speedy delivery.

- **Efficient utilisation of drivers**

The data available in the GPS tracking system makes it easy to select the right driver for the right route by way of analyses. Optimizers may use a driver's smartphone with

tracking software to get a wide range of mobile data. This helps in tracking the exact location of an employee and also confirms the time period that he has been lagging there. Optimizers can monitor cases of loafing without any trouble, analyse in case there is need of more staff to do the job, and reduce overtime, a key expense at peak times.

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- **Selecting most suitable options**

Optimizers aim to plan workflow, distribute vehicles and resources and administer the workload using various latest technological features. Furthermore, with the help of available data they are able to successfully analyse and choose the most suitable option. Information is freely available, comprising the metrics of all routes, each delivery and each vehicle on the road. Optimizers can track the behaviour of the workers and the efficiency of current methods.

- **Making fuel cost suitable**

Making use of the most effective route even during hours of rush conveys the efficiency of the vehicle to use less fuel. Fuel consumption happens to be one of the prime expenses for a fleet manager. More savings when optimizers can make best use of the vehicles owned by the company, thus they can carry on with these vehicles which are in good condition, reducing the need to buy new ones. When all vehicles of the fleet are used to the best advantage, of wear and tear is obviously reduced, elongating their effective life. Consequently, less money is required to be spent on repair and part replacement.

- **Keeping customers happy**

By organising dispatches by way of making adjustments to delivery timings, fleet managers are able to provide better service to their customers. By way of scheduling fleets even last minute changes in time of delivery can be very well accommodated them. Happier customers indicate better retention and more referrals which in turn proves to be excellent for the company's financial health.

Freight Consolidation

Joining together cargo from more than one transporter and/or to more than one consignee for shipment is called freight consolidation. On reaching its destination the container is unloaded, and each separate consignment is handed over to its apt consignee. The same situation is applicable where a lone shipper or consignee combines small shipments for its own use, or organizes this be done by a logistics provider hired for this purpose. Companies providing consolidation services generally do the job of carriers, providing their own house transport documents that are supported by a master transport certificate issued by the under carrier for the complete consolidated consignment. This activity is also known as groupage.



Freight consolidation: It refers to the activity of joining together cargo from more than one transporter and/or to more than one consignee for shipment.

Freight consolidation is offered by the transport companies to bring down the over-all cost of transportation and to augment shipping security. Consolidation service over-all consists of the cargo transportation to the collection point, filling the container and arrangement of cargo in it, thorough checking of shipping documents as per custom norms and finally re-packing the consignment for delivery. Freight consolidation is also known by the names of consolidation service, assembly service, and cargo

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Reverse logistics: It is that combination of activities which are conducted after the sale of a merchandise, for example servicing, repair and reusing, for the purpose of recapturing value or appropriate disposal.

consolidation. The service of freight consolidation if correctly provided can prove to be profitable for both, the customer and the freight forwarder.

Advantages of freight consolidation

- Freight consolidation is beneficial especially in monitory terms, both for the consumer as well as the transporting company.
- When small merchandises are consolidated with larger freight it provides a kind of security which might be lacking in case of such goods being carried by themselves. The more the number of shipments, the risk of interruption n smooth delivery also increases. Consolidation therefore reduces this risk and increases the delivery system of the firm.
- Freight consolidation decreases the number of separate deliveries received. Therefore, creating a single channel of delivery. Merchandises from various suppliers can be put together in a single pre-arranged delivery at any one convenient time

Reverse Logistics

Reverse logistics is that combination of activities which are conducted after the sale of a merchandise, for example servicing, repair and reusing, for the purpose of recapturing value or appropriate disposal. Reverse logistics characteristically encompasses returning a product to the producer or distributor or sending it along for treatment in the final stages of the product's lifecycle. Sometimes, this process is also known as after-market supply chain, after-market logistics or retrogistics.

Managing reverse logistics in an efficient way is a formidable challenge for almost all businesses. Quality, service, costs, environmental and legislative issues are strategic concerns which ought to be managed in addition to the functional challenges stated above. Effective and fruitful reverse logistics systems and programs considerably increase customer satisfaction, bring down indispensable allocations storage, energy, and other resources.

Customers are always on the lookout for better and satisfactory results. So, many suppliers exploit external logistics management to ensure full satisfaction of customers and their continuous and repeat purchasing.

Companies that integrate reverse logistics systems into their logistics systems rise above their competitors in the following:

- Operational organisation of catalogue availability and price
- Reverse logistic cycle time regulation
- Significant and precise performance metrics
- Openness to instable market demands
- Reputation for excellence in reverse logistical results
- Customer satisfaction

Management of returns is a consumer service essential for a company to balance the needs of its customers and provide reasonable merchandise and service worth and the company's requirement to harvest profit. In order to benefit both requirements,

companies are all the time trying reverse logistical operations so that transportation management fits in naturally.

Striking a balance between all costs related to moving, handling, and transporting returns and/or exchanges, in combination with warehousing tasks, leads to a logistical initiative which is generally not among the core competencies of a company. In such circumstances, it is prudent to take assistance from experts in freight management, logistics, and reverse logistics systems implementation to augment client service and maximize possible profit.

5.3.2 Outsourcing Fleets from Others

In the present day business scenario, logistics collaborations are becoming more and more common. Such practices were nearly unheard of some years ago, whereas such settlements are nowadays thriving in order to lower delivery and storage operation costs. For numerous producers and merchants, these undertakings present prospects to vividly develop the quality of consumer service.

In an agreement to outsource a fleet of vehicles for delivery and distribution, typically two parties are involved: a company providing tailor made logistics services and a manufacturer of goods and both these parties together concoct and set forth a system to speedily deliver goods to customers. These kind of arrangements have other forms too, e.g., arrangements between two service providers or between two merchandise dealers.

Outsourcing of transportation or warehousing requirements to a specialist is, undoubtedly, a routine matter. What is uncommon about the relations defined here is the novel way in which the parties combine their operations to derive mutual profits. Another characteristic of these arrangements is the team work they stimulate that substitutes the occasional oppositional attitude separating purchasers and sellers. At times, such relationships carry on for five or more years, and with passage of time any of them begin to function with casual understandings instead of formal contracts.

In these associations, the service supplier ordinarily undertakes a certain amount of risk by way of an agreement asking for a penalty, such as an involuntary decline in revenues, when the output is more sluggish than specified. On the contrary, the fleet hire agreements often include extra payments for superior or out of the ordinary performance, for example, a greater than anticipated ratio of on-time delivery. As indicated, the risk also may include a capital investment on the provider's part.

Sometimes, however, the co-operation acquired contains less risk for one of the associates in the agreement. Let us take example of a Fiberglass company which in order to increase output and gain competitive advantage, has taken on some jobs that are customarily the transporters' liability. Once a haulier transports ready-to-use trailers to this company's plant, its on-site accountability finishes. The producer places the delivery vehicles at designated places and loads them according to destination. Timing consignments for less crowded traffic times helps in reducing cost and increase driver productivity. The movement on the road, direct from the company's plants to customers' construction sites circumvents costly pickup and origin terminal routing cost. Obtaining lower functioning charges and predictable apparatus location, the carriers can lessen their freight rates. They share the savings with the company. For the producer,

nevertheless, the ultimate benefit is the competitive benefit it obtains by supplying reliable job-site supply within limited time windows.

Forces encouraging impetus of outsourcing

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Amongst the variety of reasons building a favourable atmosphere for logistics alliances, such as outsourcing fleet, four are of utmost importance.

1. The political-legal territory of the 1980s encouraged the expansion of integrated service practices. Deregulation of transport and communications services, along with tranquil antitrust implementation created an environment favourable to innovation.
2. The blast in information technology has made mechanization inexpensive, and computers grip logistics agreements together.
3. Current stress on thinner business organisations induces managers to turn to outside consultants and experts to solve problems or they carry out tasks outside the organization's scope of proficiency. The aim of contending more efficiently is one of the main stimulants towards logistics co-operation.
4. An ever increasing competitive atmosphere encourages the contenders to do their best in order to become lowest cost competitors. Competence in logistics is mainly important for companies operating their businesses abroad. Free from the rouble of managing a mundane task like delivery of goods, the company is able to focus on more worthy jobs like outdoing competitors, quality control, customer satisfaction, etc.

Developing the faith to make the outsourcing alliance work entails an open door and an open mind policy. This attitude does not come easy for managers who have grown following professional adversarial practise. For instance, the confidence that transporters and warehouse-based service companies encourage the alliance concept as a ploy for selling the same old service is prevalent amid shipper executives. In such a situation obviously, the business output get negatively affected as the service provider who works under a constant shadow of doubt is unable to use his discretion in adverse situations leading to loss of time.

In the old-fashioned kind of intervention of a service agreement, the manner is adversarial and the parties depend on a multitude of competitive checks and balances to guarantee buyers that they are in for a good deal. In an alliance, such as, outsourcing a delivery fleet trust has to substitute for several of the apparent benefits of competitive bidding. The reluctance of the partners to share ideas can end an agreement, once arrived at, in such agreements both parties even have to share a plethora of information regarding the merchandise being transported, routes being followed, etc.

Here the tough question is how do you muster trust in circumstances where there have been no track records in the past? One way to resolve this problem is by means of a procedure where the means is a neutral facilitator acceptable to all concerned who is actually connected with none of them. This individual, attempts to put the talks on an objective basis by acting as the neutral focal point during the bargaining. As the alliance develops, the level of trust and functional success start to go hand in hand. Failure to nurture trust through the early stages brings about trouble. It is often seen that in an alliance, in reality one, of the parties usually has more at stake than the other.

There is often an imbalance of power as well. The result: uneven commitment to the welfare of the arrangement. So in such situation also the efforts of the neutral facilitator help to bridge the gap thus helping both businesses to derive maximum out of the alliance.

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5.4 ROAD INFRASTRUCTURE AND LOGISTICS ISSUES

The road transport sector in India has arisen as a leading part of the transportation system in India, it has come to dwell at a central position in the vast transport system in India. This sector is developing at the rate of 10 per cent each year. Numerous aspects are assisting the advance of logistics industry in India over the past few years that comprises altering tax system, fast development in industries like auto, medicines, FMCG and retail. Snowballing competition and cost, focus on outsourcing, and entry of foreign players are all having a positive impact on the industry.

Infrastructure is one of the prime challenges confronted by the Indian logistics sector and has been the foremost constraint to its growth. Infrastructural difficulties like bad road conditions, poor connectivity, insufficient air and sea port capacities and lack of development of modes of transports like railways and alternatives like domestic water transport and inland aviation have been continuous annoyances. Due to the infrastructural blockages in the Indian logistics sector, the cost per deal is much higher in comparison with developed markets. Less economy of scale due to high disintegration of industry, lack of skilled labour and personnel also pose as major challenges for the logistic sector.

The Indian subcontinent experiences different challenges vis-a-vis developed countries. In western nations demand poses a problem; whereas in India, management of demand is what has been a great challenge. India still has a long way to go with respect to best practices. Most Indian companies have yet to mature with respect to demand driven value network. Other than the aforementioned challenges, the main test is the lack of human resources trailed by infrastructure with respect to logistics.

The Indian transportation market is estimated to carry on presenting important opportunities to all concerned stakeholders. Nevertheless, for the sector to extend to its complete potential, the timing and finances would be dependent on how the various drivers and inhibitors grow in future. While the quality of road infrastructure is surely expected to develop, the speed of infrastructure development is critical to curtail economic as well as environmental losses.

To improve upon the situation, delays in fulfilling project timelines should be minimized, assuming that only around 52 per cent of the everyday target of average road length to be built has been met. Nevertheless, not only has there been a rise in the demand for road connectivity, emphasis on improving fundamental road infrastructure as well as technology adoption has also been on the rise in recent years. The number of expressways and highways has increased; countless roads have been broadened; automated toll collection is becoming more and more common; the 'green channel' notion is finding ground, and inter-state check posts are also being automated.

Check Your Progress

4. Why is owning a fleet beneficial for businesses working with time constraints?
5. What does the 2 type maintenance characteristically include?
6. What is groupage?
7. Mention other names for the concept of reverse logistics.

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A country's capacity to carry out business globally is dependent on the access it grants to its traders to world-wide freight and logistics networks. And the competence of a country's supply chain (in price, time and dependability) depends on particular characteristics of its domestic economy (logistics performance). Better general logistics performance and trade assistance are intensely related with trade expansion, the success of which is largely based on an efficient transportation network, which is the back bone of any logistics systems. Let us now have a look at the weakness faced by India's logistics infrastructure.

Indian economy is evolving as one of the world's foremost consumer markets. It anticipates to sustain strong development in the years ahead and endeavours to become one of the top three economies in the world by the century's middle. The logistics sector plays a key role in supporting this cause and the connectivity and convenience in operations is important for supporting global trade growth.

Infrastructure development is the most important element for the development of any economy. Logistics infrastructure including road, rail, waterways and air network is the mainstay of a country's financial health. An ideal state of affairs would be to have ample and satisfactory infrastructure capacity based on which the different modes of transportation could form a logistics chain for smooth flow of goods and services. The present scenario provides a foundation from where the Indian logistics industry can take an enormous jump.

Despite appearing promising, the Indian road logistics sector remains caught up in numerous complexities which hold it back in one way or another. These contain momentous inadequacies in transport, bad conditions for storing infrastructure, a rigid and complicated tax structure, adoption of technology at a low rate of and poorly skilled of the logistics specialists. A multimodal solution is still awaited. Warehousing service is still considered to be a real-estate business than a logistics service. Optimisation by clubbing infrastructure has just begun, but still there is a long way to go.

In order to improve the present logistics condition in India, there is need of a fast-tracked development and growth of logistics infrastructure; intensive measures to improve EXIM volumes by the Government and serious endeavours to improve capabilities and quality of services by participants in the logistics sector are required to stop this deterioration. There is a need for the government to try and bring speedy development of national and state highways, improve upon other facilities for smooth movement of traffic on Indian roads, provide dedicated rail freight corridors, cargo capacity and capability to lodge larger and more number of ships at sea ports.

5.4.1 Role of National Highways and the Toll Highways

In this section, we will discuss the role of national highways and toll highways in the roadways and logistics economics.

National Highways

We have learnt about this topic in the previous unit, let's recollect the important points here in this section. The primary roads, constructed and maintained by Central Public Works Department (CPWD), are called the National Highways. These roads are supposed the serve the purpose of facilitating inter-state and tactical defence movements

and link the state capitals, major cities, main ports, big railway junctions and provide a connection with border roads. Nearly 40 per cent of the road traffic in India moves on the National Highways. National Highways spread across the length and breadth of the country and facilitate carriage of people and cargo from one place to another.

The construction and upkeep of the National Highways lies with the Central Government, the National Highway system totals up to a length of 58,112 km. In order to provide an impetus to the economic progress of the country, a gigantic programme has been undertaken by the government since 1996 under which about 13,000 km of National Highways have been converted to 4/6 lane roads, this project is called the National Highways Development Project (NHDP).

This is possibly one of the largest road development projects ever taken up by any nation. The project is being effected by National Highways Authority of India (NHAI). Apart from volume expansion by making National Highways 4 or 6 lane broad, the government has also initiated the programme for making improvement in driving quality of National Highways. In order to provide reasonable service level to traffic, within the available resources, a programme for improvement of riding quality, which is basically partial strengthening, was undertaken. The programme was funded under both plan and non-plan funds. About 22,000 km of National Highways have since been improved under the programme and the work of improving upon the National Highways is an ongoing effort seeing the light of every day.

Roads can help development of a nation by aiding trade and migration, and reducing barriers standing in the way to spread new technologies. A recently growing body of research looks at how the upgradation of the Golden Quadrilateral led to higher admission of manufacturing firms (Kerr et al. 2014, Asturias et al. 2015). While these consequences show the instantaneous effects of road networks, it is of utmost importance to examine the long-term effect caused by them as well. The National Highway networks give rise to a vigorous pattern of a four-dimensional growth and expansion over a long period of time and that the instantaneous effects may in fact enormously undervalue the fact that how important roads are.

Isolating the impact of national highway systems on development of the nation is challenging for numerous reasons. Richer states and affluent regions have more potential to develop faster hence these places are generally considered before the other at the time of building roads and upgrading their infrastructure. Sometimes governments take a decision to build roads in regions that are anticipated to develop. Therefore, looking at development in areas along the national or state highways does not clearly impart the fact whether roads caused the development or that the development was the reason that lead to construction of more roads.

The highway system in India was first initiated to connect the four major metros – Delhi, Mumbai, Kolkata and Chennai – this route was called the Golden Quadrilateral. While, when drawn on paper, the shortest path between these metro cities would be straight-lines between them. Nevertheless, the highways are laid out on a path determined by the terrain of the land and perhaps the development of areas that they cross. The straight lines are simply a geometric concept and thus, totally independent of aspects such as topography, land acquirement issues or the level of regional development, which influence the real placement of highways. Therefore, these geometric straight lines may be utilised as representations of the highways in order to segregate the effect

of roads on development, from the other aforementioned factors. Thus, these straight lines can do the job of indicators for these transit networks, that can help separate the effect of roads on development from the above mentioned confusing factors.

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To comprehend the regional impact on National Highways or vice versa, it is compulsory to possess dependable data at the sub-regional level. Nonetheless, this data is very difficult to obtain. Well, to precisely measure complete economic activity, satellite data on night-time light density can be made use of which does total justice to prediction of regional income in the absence of good disaggregated GDP numbers (Henderson, Storeygard and Weil 2012).



Toll road or a toll-way: It is a community or reserved road for use of which a charge (or toll) is assessed.

Toll Roads

A toll road or a toll-way is a community or reserved road for use of which a charge (or toll) is assessed. The toll levied on passer-by commuters is applied to help recover the expenditure incurred on construction and maintenance of that road. This toll is charged only for the period till such expenditure is recovered and thereafter it is free for usage by all. Different amount is charged from different vehicle depending on their size and type. Commercial vehicles are charged more than small private vehicles.

In some or the other form toll roads have been in existence since antiquity, collecting toll from travellers passing on foot, cart or horseback; but their eminence amplified with the rise of the automobile. There are numerous contemporary toll-ways which charge fees exclusively for motor vehicles. As aforementioned, the amount of the toll characteristically differs depending on the kind of vehicle, its weight, or number of axles, trucks carrying cargo are generally charged higher rates than cars.

Many countries have the provision toll bridges and toll tunnels over and above toll roads, these help generate funds to recover the cost of constructing these structures. Some tolls are kept separately to pay for future upkeep or improvement of infrastructure, or are implemented as a general fund by local governments, these funds are not utilised towards transport facilities.

Conventionally, road tolls were charged for a particular access for example, entry into some city/town or for a particular infrastructure for example, a specific road or a bridge. These concepts were in extensive used till about the previous century. However, the development in technology made implementation of road tolling policies possible, which is based on various concepts. With the expanse in the number of vehicles in India the need for extensive roads providing for thousands of vehicles driving across the country has become unescapable. Construction of toll roads in the country has proven to be very beneficial for the traffic health of India. These roads provide dedicated corridors leading to specific places thus making travel easy for those commuters who intend to reach that particular place. Their access being chargeable discourages casual motorists out on the roads without any particular reason. Toll roads have been able to bridge the gap between places making life much easier for people leaving in satellite towns like Delhi and Gurgaon. The Delhi Noida Delhi toll road is one such example which bridged the gap between Delhi and Noida by many kilometres.

Check Your Progress

8. List some of the Infrastructural difficulties which have been continuous annoyances for roadways in India.
9. How has the construction of toll roads in the country has proven to be very beneficial for the traffic health of India?

5.5 TECHNOLOGY, COST, SPEED, SECURITY AND DYNAMICS IN ROADWAYS

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Some other factors important in the roadways and logistics economics is discussed in this section:

1. Technology

In the contemporary world where a phone is not only an instrument to make and receive calls, similarly roads should no longer stay as a medium to just travel from one place to the other. They can be used to charge electric cars and collect solar energy because of their huge surface area exposed to the sun. Intelligent transport systems and predictive methods are being developed to allow advanced modelling and comparison with historical baseline data.

In spite of the countless advances in the field of technology towards big and small vehicles, mobile devices, very little changes have been made to asphalt roads. Well, there is a desperate need (especially in India) to work towards upgradation of roads and implement measures that can aid innovation and make driving experience better, special attention needs to be drawn towards road safety.

After smart phones, smart banking smart TVs etc., it is high time that people thought about start building smart highways, which seems to be the need of the hour. Road technology has got a lot to do with road security and implementation of advanced technology in construction and maintenance of roads will definitely help in reducing travel time, lessen the number of road accidents, enhance driver comfort and make travelling by road a pleasurable experience for travellers. Let's have a look at the futuristic technology proposed by some road construction experts that may see the light of day very soon.

• Glow-in-the-dark technology

Instead of spending a humungous amount of money on road lighting or other lighting options that spread across thousands of kilometres of highways and other city or district roads, it will be much more economical to use glow in the dark road markings. Such advanced technology is already in use on certain highways of Netherland.

• Interactive light

Other than using glow paint for road markings, the other idea is to use interactive or motion-sensor lights. Such a light comes on automatically when a vehicle comes close to a particular part of a road. This option is a good idea for less frequented roads and highways interactive lights facilitate night driving by providing visibility in the night as and when required.

• Electric priority lane

Taking as electric powered cars as the future of the automobile industry, another innovative and stimulating idea presented by road infrastructure visionaries is that of the Electric Priority Lane. Through these lanes, electric vehicles (EV) drivers will be able to charge up their cars while on the move by just driving on the right lane. The

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Induction Priority Lane will be embedded with magnetic fields that will have the capability of charging a moving vehicle. This futuristic vision will make sure that electric cars do not need to search charging stations to keep moving, and can even keep their cars charged on long journeys.

- **Solar roadways**

Another futuristic suggestion is that of constructing renewable, environmentally friendly glass roads. Glass is a substance which can be worked upon to be made even stronger than steel. The surface of these solar panels fitted into the roads can be engineered for cars in such a way that they are be able to brake safely even at high speeds, just the way they do on regular roads. The solar panel roads will have the capability to even melt snow during winter and of course the solar energy collected can be used for powering electrical requirements.

2. Speed and Security Dynamics

Recent improvements in vehicle electronics have led towards lesser but more capable computer processors in vehicles. A normal vehicle in the early 2000s generally used to have between 20 and 100 separate networked microcontroller/Programmable logic controller parts with non-real-time operating systems. The present tendency is to have lesser but more expensive microprocessor components with hardware memory management and real-time operating systems. The new inserted system boards make space for more sophisticated software applications to be implemented, with model-based process control, artificial intelligence, and universal computing. Possibly the most significant of these for Intelligent Transportation Systems is artificial intelligence. Such advances have empowered vehicles to such fast speeds which could be no one's imagination about two decades ago. Well, advancing technology has not only the driver of a vehicle with the pleasure of speed and comfort but have also catered to adequate safety measures in all vehicles. Let's have a look at some of these technologies:

(a) **Triangulation technique:** In developed countries a large number of cars contain one or more mobile phones. The phones intermittently communicate the information of their presence to the mobile phone network, even in idle condition. The signal of a mobile phone would move with the car carrying it. By gaging and examining network data by way of the triangulation technique, pattern matching or cell-sector figures (anonymously), the data was transformed into traffic flow information. More phones obviously meant more cars, hence more congestion. The advantage of this technique is that for monitoring flow of traffic, there is no need to build infrastructure along the roads; only the mobile phone network has to be leveraged for this purpose. While it sounds very good and technically advanced, but in practice the triangulation method may be complex, particularly in areas where the same mobile phone towers serve two or more parallel routes (for example a motorway (freeway) with a frontage road, a motorway (freeway) and a commuter rail line, two or more parallel streets, or a street that is also a bus line. The triangulation method of tracking started declining in about a decade of its inception.

(b) **Re-identification of vehicles:** Re-identification of vehicles is a technique which requires a number of sensors mounted along the road. In this method, a distinct

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serial number for a device in the vehicle is spotted at one location and then identified again (re-identified) after some distance the road. Speed of the vehicle is calculated by making a comparison of the time gap between two identifications. By use of this technique, over speeding vehicles can be checked thus increasing road safety

(c) **GPS based methods:** More and more number of vehicles are fitted with in-vehicle satnav/GPS (satellite navigation) systems that are enable with a two-way communication with a traffic data provider. Position readings from such vehicles are utilised to calculate vehicle speeds.

(d) **Smartphone-based rich monitoring**: Smartphones are equipped with sensors which can be used for tracking traffic speed and density. The speedometer data received from smartphones used by car drivers is observed to ascertain traffic speed and quality of the road. Audio data and GPS labelling of smartphones allows identifying traffic density and possibility of any traffic jams.

(e) **Inductive loop detection:** Inductive loops can be located in a roadbed to identify vehicles as they pass through the magnetic field of the loop. The most simple detectors just compute the number of vehicles in a unit of time (may be one minute) that cross the loop, while more advanced sensors evaluate the speed, length, and class of vehicles and the distance between them. Loops can be positioned in one lane or in several lanes, and they come into action on detecting a very slow or stationary vehicle and they also have the capability to detect very fast moving vehicles.

The data thus received using these technologies can be put together in intelligent ways to accurately conclude the state of traffic. Such a move can highly increase the road safety and security and other dynamics of road travel and transportation.

5.5.1 Competition: Roadways Vs Other Means of Transport

It is a recognized fact that amongst all modes of transportation, transport by road is the closest and most viable for people all over the world. Even while travelling or transporting goods by other means, the traveller and the merchandises have to be first conveyed by road to the place of origin of their journey, i.e., a railway station, a sea or an airport. A variety of vehicles move on the roads of different countries throughout the day and night, for instance, private cars, public buses, freight carrying trucks, two or three wheelers, pedalled cycles and bullock or horse drawn carts. But railway tracks do not enjoy this versatility as they can be used only for movement of rail engines and carriages, same way water ways can be used only by ships and boats.

In comparison to other modes of transportation, road transport requires a comparatively small investment for the government. Motorised vehicles cost a lot less in comparison to carriers like trains, ships and airplanes. Besides this, construction and maintenance of roads is also more economical than that of railway track, docks, harbours and airports.

Road transport offers full freedom to road travellers to move their vehicles from one lane to another or from one road to any other particular road according to the need and convenience, or in case of a change in plan. This advantage enables travellers to cater to any unforeseen happenings, whereas this luxury is just not possible while using other modes of transportation. A traveller who has begun his journey to reach a

certain point cannot change his course of direction mid-way. The flexibility of changes in place, direction, speed and timings of travel is not available to other modes of transport.

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For short-distance travel in particular, road transport comes out to be very time friendly. Trains halt at many intersections and stations for reasonably long time, thus proving to be unfit for emergency travel situations. Air transport, though fast, is not a viable option because of the expenses involved and unavailability at all places. Easy availability of road transport throughout the country makes this mode the most popular choice of people. Roadways is the only mode of transportation which can offer a door to door service to its customers. While sending cargo, today consumer has the option of ordering a pick from home and delivery at the door step of the consignee.

5.6 SUMMARY

Some of the important concepts discussed in this unit are:

- Road and train networks which were once used to carry freight from coasts or waterway ports to their ultimate destination, have greatly expanded making freight transportation from port to port overland more efficient and more affordable than the marine transportation of freight.
- The charge for transporting goods is called freight rate. This is a reflection of a variety of factors other than average transportation charges. The main determinants of freight rate are: selection of means of transportation (road, sea, train, air), weight and size of the consignment, distance to be traversed, points of pickup and delivery, and nature of goods being transported.
- The current road freight industry, is controlled by small provincial operators, which makes freight rates very volatile. The current market is largely effected by issues like supply demand of vehicles, seasonal changes, fuel price rise, off-loading shipments etc.
- The Road Freight Index (RFI), is the first of its kind enterprise by Transport Corporation of India, initiated in the year 1998. The Road Freight Index (RFI) is an index of weighted average freight rates accumulated through numerous routes, quite like to a stock market index. The Road Freight Index (RFI) is an instrument, which helps in making an all-inclusive analysis of freight trends, according to the route and date and helps in forecasting the freight trends and freight rates for the near future.
- Determinants of freight rates in India are: cost of merchandise, fuel charge, weight of merchandise, size of merchandise, distance to be covered and delivery time.
- A modification in the road freight transport price, especially in the longer run, may have varied effects on road freight transportation. These effects are generally expressed in the form of elasticities.
- There can be a variation in price elasticities due to: different segments of the market, different constituents of entire transport costs, price upsurges vs declines, different magnitude in price changes and different characterisations of a transport mode.

Check Your Progress

10. What are electronic priority lanes?
11. State the advantage of triangulation technique.
12. How does the re-identification method work?

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- A fleet is a group of motorised vehicles owned or leased by a corporate, government or non-government agency or any other association not for personal but commercial use. Based on the type of industry, possessing and working a delivery fleet can be important to the growth and expansion of a company.
- Vehicle capacity counters are an excellent tool to record ever move made by the vehicle. Besides, the intake relevant counter reading record for vehicles can be used to log the number of kilometres travelled by or the hours of operation of the vehicles.
- Commercial vehicles have to be on the road perpetually. All said and done, there is hardly any respite for these vehicles as within no time of their docking, they are back on the road. That's why it is essential to make and follow an effective fleet maintenance plan to ensure that all vehicles being used stay serviceable.
- Freight units are the beginning of the optimization process. They drive fulfilling the demand and complete the optimization process. These units define, what needs to be transported, from which place to which place and when. The job of the optimizing agency or individual is to match these freight units with the available capacity.
- Joining together cargo from more than one transporter and/or to more than one consignee for shipment is called freight consolidation. On reaching its destination the container is unloaded, and each separate consignment is handed over to its apt consignee.
- Reverse logistics is that combination of activities which are conducted after the sale of a merchandise, for example servicing, repair and reusing, for the purpose of recapturing value or appropriate disposal.
- In an agreement to outsource a fleet of vehicles for delivery and distribution, typically two parties are involved: a company providing tailor made logistics services and a manufacturer of goods and both these parties together concoct and set forth a system to speedily deliver goods to customers. These kind of arrangements have other forms too, e.g., arrangements between two service providers or between two merchandise dealers.
- Infrastructure development is the most important element for the development of any economy. Logistics infrastructure including road, rail, waterways and air network is the mainstay of a country's financial health. An ideal state of affairs would be to have ample and satisfactory infrastructure capacity based on which the different modes of transportation could form a logistics chain for smooth flow of goods and services.
- The primary roads, constructed and maintained by Central Public Works Department (CPWD), are called the National Highways. These roads are supposed the serve the purpose of facilitating inter-state and tactical defence movements and link the state capitals, major cities, main ports, big railway junctions and provide a connection with border roads. Nearly 40 per cent of the road traffic in India moves on the National Highways.
- A toll road or a toll-way is a community or reserved road for use of which a charge (or toll) is assessed. The toll levied on passer-by commuters is applied

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to help recover the expenditure incurred on construction and maintenance of that road. This toll is charged only for the period till such expenditure is recovered and thereafter it is free for usage by all.

- Some of the futuristic technology proposed by some road construction experts that may see the light of day very soon: Glow-in-the-dark technology, Interactive light, Electric priority lane and Solar roadways.
- Advancing technology has not only the driver of a vehicle with the pleasure of speed and comfort but have also catered to adequate safety measures in all vehicles. Some examples of these technologies are: triangulation technique, re-identification of vehicles, GPS based methods, smartphone-based rich monitoring, inductive loop detection, etc.
- In comparison to other modes of transportation, road transport requires a comparatively small investment for the government. Motorised vehicles cost a lot less in comparison to carriers like trains, ships and airplanes. Besides this, construction and maintenance of roads is also more economical than that of railway track, docks, harbours and airports

5.7 ANSWERS TO 'CHECK YOUR PROGRESS'

1. The external factors which are important for the determination of freight rate are consolidators, customs brokers, freight forwarders, because of their skill, business relationships, and the size of their operations.
2. The Road Freight Index (RFI) is an instrument, which helps in making an all-inclusive analysis of freight trends, according to the route and date and helps in forecasting the freight trends and freight rates for the near future.
3. The benefit of elasticities is that they do not have any dimensions, to say that, a variation in the unit of dimension (for instance from kilometres to miles) does not have an effect on the elasticities.
4. Owning a fleet for businesses working with time constraint, e.g., bakeries or flower delivery shops may prove to be more efficient as they will not have to depend on an external service to deliver their fresh merchandises on time.
5. 2 type of fleet maintenance characteristically includes oil and grease change for smoother gear change.
6. Companies providing consolidation services generally do the job of carriers, providing their own house transport documents that are supported by a master transport certificate issued by the under carrier for the complete consolidated consignment. This activity is known as groupage.
7. Reverse logistics is also known as after-market supply chain, after-market logistics or retrogistics.
8. Infrastructural difficulties which have been continuous annoyance for roadways are bad road conditions, poor connectivity, insufficient air and sea port capacities and lack of development of modes of transports like railways and alternatives like domestic water transport and inland aviation.

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9. Construction of toll roads in the country has proven to be very beneficial for the traffic health of India as these roads provide dedicated corridors leading to specific places thus making travel easy for those commuters who intend to reach that particular place. Their access being chargeable discourages casual motorists out on the roads without any particular reason.
10. Electric Priority Lanes are lanes for charging up electric vehicles (EV) while on the move by just driving on the right lane.
11. The advantage of the triangulation technique is that for monitoring flow of traffic, there is no need to build infrastructure along the roads; only the mobile phone network has to be leveraged for this purpose.
12. In the re-identification method, a distinct serial number for a device in the vehicle is spotted at one location and then identified again (re-identified) after some distance the road. Speed of the vehicle is calculated by making a comparison of the time gap between two identifications. By use of this technique, over speeding vehicles can be checked thus increasing road safety.

5.8 QUESTIONS AND EXERCISES

Short-Answer Questions

1. What are the main determinants of freight rate?
2. Write a short note on tracking of freight rates.
3. Why do the differences in the values of elasticities arise in road transport?
4. Briefly explain the concept of fleet maintenance.
5. What are the advantages of fleet consolidation?
6. How do companies benefit from reverse logistics?
7. What are the infrastructural issues in road logistics?
8. Briefly list the benefits of roadways over other modes of transport.

Long-Answer Questions

1. Discuss the determinants of freight rates in India.
2. List the response mechanisms for the effect of a change in the price of road transport on road transport demand.
3. Explain the advantages and disadvantages of owning a delivery fleet.
4. What is to be kept in mind while scheduling the movement of a fleet?
5. Write an essay on 'outsourcing fleet from others in road transport'.
6. Describe the role of national highways and toll highways.
7. Examine the different technologies that are intended for speed and security in road transport.

UNIT 6 COORDINATION AMONG DIFFERENT SEGMENTS

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Structure

6.0 INTRODUCTION

Till now, we have learnt about the important modes of transportation and the nuances related to logistics involved in managing such modes individually. But, railways or roadways does not work in isolation, these modes are directly and indirectly dependent on each other. Additionally, it is very important for the parties involved to get the best out of all the modes of transport and not just be restricted by the competition amongst these modes. The coordination amongst the different segments of these individual modes and all of them together is a complex task, but if done right, it will benefit the country and its resources manifold. In this unit, you will study about the coordination among different segments, the identification of the need and varied areas involved, the energy product prices and environmental factors and their role in the logistics and other related concepts of road cargo movement.

6.1 UNIT OBJECTIVES

After going through this unit, you will be able to:

- Discuss the concept, need and areas of coordination among different modes
- Describe the coordination among supply chain partners
- Examine the energy product prices and environmental factors in relation to logistics
- Identify the problems and prospects in interstate logistics by road
- Assess the role of truckers' bodies in road cargo movement

6.2 CONCEPT, NEED AND AREAS OF COORDINATION AMONG DIFFERENT MODES

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Let us discuss the important elements of coordination among different modes of transport.

Concept

The collaboration between various means of transportation for their involvement in the unified transportation procedure is to guarantee management and effective collaboration of the technological processes for all the stakeholders. Balanced collaboration of various means of transportation then lays the foundation for the operational working of the country's cohesive transportation system.

The harmony of the transportation structure leads us towards the determination of the main profitable zones of activity of the respective means of transport, the introduction of progressive technology and means of interaction, and the coordination with the state of the modes working together, all for the purpose of hastening the process of transportation and cutting costs.

The area for the operative implementation of each means of transport is decided, depending on its procedural and financial features, place of transportation infrastructure in the country or city/town, expenditure and the conveyance time. The interaction of various means of transport happens primarily in the transport nodes where traffic flows are administered and used by travellers and merchandises.

The collaboration between different modes of transport involves the coordination of processes. The aim of this synchronization is to even out the capacities of transportation through various means and different technologies; and the groundwork of coordinated timetables for diverse transport means. In order to achieve this aim, special plans and graphics are worked out, especially a nonstop plan of transport node procedure. This plan is brought into action for the purpose of coordinating of all kinds of transport activities in real time to diminish the impact of instability to transport process.

Coordination amongst different means of transport is very important as unhealthy repercussions of technology and other differences in the organization of their collaboration has the following disadvantages:

- Additional volume of transfer points because of lack of specialization
- Discrepancies in developing collaborative modes of transport
- Discrepancy in timetables of modes of transport co-operating with each other
- Lack of interest in developing intermodal process of transportation
- Wrong calculations in scheduling and management of the process of transportation
- Defectiveness of the transport-acceleration process
- A small portion of the trans-shipment

The level of expansion and growth of transport organization; the aspiration to lessen the cost of transport and to escalate the speed of delivery in market conditions are the factors which lead to the selection of interaction between various modes of transportation. The selection ultimately aimed to serve the needs of specific freight or passenger flow.

Marketing study of the different means of transportation consist of the use of numerous kinds and techniques of collaboration and competition for meeting the ever varying needs of consumers in transportation services and more effective utilization of transportation resources. In a market economy, the main necessities of consumers are on a settled collaboration and organisation of the various means of transport to deliver shipments which are primarily based on the principles of 'door to door' and 'in time' delivery of goods.

Need

The developed countries of the world have somehow been able to strike a good working balance amongst all means of transportation prevalent. This has smoothened the process of freight and human transportation, thus bringing an added advantage to an already prosperous economy. As discussed in the preceding section, trade is the heart and soul of any nation's economy and this heart gets it beating to survive from the means of transport established in the country. Coordination amongst various means of transport is absolutely necessary in developing countries so that the utilization of scarce resources is efficiently fulfilled.

Undesirable rivalry amongst different means of transport can be removed by the way of coordination amongst railway and roadways; shipping and airways. Existing competition amongst these means of transportation is the main limitation of the development of transport sector. The administrations of nearly all developing countries are earnestly involved in looking for the most appropriate coordination policy among different means of transport. Coordination in means of transport boosts the overall economic development of a country.

The aim of striking a coordination amongst different means of transport is the ability to make joint use of a country's transport resources and potential in a way that maximum benefits can be derived from each kind of transport, depending on the intrinsic advantages of each as revealed in operational costs and standards of service.

Guidelines for developing transport coordination policy (with special reference to developing countries):

- Cooperation in providing facilities for a hassle free trans-shipment of passengers and goods amid areas serviced by diverse modes of transportation.
- Individual form of transport must be brought into use with its most appropriate scopes, where it is provided with the opportunity to perform in an efficient and economical manner.
- Maintaining a balance while providing transportation facilities is of utmost importance. This means, that the authorities must ensure that such a situation does not arise where some areas over supplied with various means of transportation facilities, whereas, others suffer an inadequate supply.

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- It is very important maintain a controlled cohabitation of all available means of transport, in order to avoid mutually wasteful rivalry.
- In developing nations, there exists a possibility of joint road-rail, rail-river and road-river services, the benefits of which include detailed booking facilities and combined management procedure. It is difficult to coordinate transportation in some countries which subsequently hampers the financial growth. Proper planning and coordination between the new and old system of transportation can help overcoming the problem.

Areas

Procedures and methodologies of coordination among different means of transport is not limited to any one field, rather it relates to the technical, technological, organisational, economic and legal fields. Let us have a look at the reasons why:

- **Technical expanse of transport coordination:** This head of coordination involves synchronisation of capabilities and handling aptitudes of cooperative systems and policies on the physical lines of transport and transport nodes. Further it endeavours to harmonize rolling stock and containers as per their size and capacity for most beneficial utilization of trans-shipment facilities and places of passengers' transfer; formation of inter-modal technical modes of communication and data transfer.
- **Technological area of transport coordination:** In the technological area, there is a need to coordinate and organize a unified operating structure of various means of transportation. Other than that, this also requires a development of contact timetables of all modes of transport which are participating in the activity i.e., hauliers and consignees. Projection of interrelated suitable arrival and departure of vehicles being used by different modes of transport also is an important task that needs attention for the purpose of smooth coordination. Organization of integrated technological procedures in big nodes and intermodal transportation lines poses a major challenge while coordinating among various modes of transport.
- **Organizational scope of transport coordination:** There is a need to develop of a single articulate system of governance of road transportation all across the country, both, at the macro and micro level. Keeping the safety of transportation and environment, in mind, there is a need to prepare documents regulating the organization of the multimodal transport process. Development of a single logistical centre can help in improving the organization of various means of transport. Following a procedure of notification and regulation of sourcing rolling stock to the loading/unloading sites and trans-shipment of goods in transport nodes brings about an ease in simultaneous mutually beneficial functional coordination of modes of transport. Another kind of coordination which can be of great benefit to a traveller or consignor of goods, is the provision of trough tickets or carriage vouchers of several modes of transport to be used in the journey or transportation. Integration of transport-forwarding services in intermodal transportation also comes in handy for users of such transport services.
- **Economic zone of transport coordination:** For coordination of means of transport in the economic zone, there is a need to develop and approve plans

and predictions of demand for transport services by different modes of transport under ownership of different individuals or firms. Based on market research, there is a need to identify demand of intermodal cargo carriage by region, so that nearby demands can be clubbed for smooth functioning and ensuring less economic strain. By evolving a strategy related to the transport sector of the nation, magnitude of essential investments and how the manner of subsidies for each mode of transport, a well-coordinated inter-modal transportation system can be setup. Economic coordination of transport sector helps in the development of a mutual operational basis for calculating operating costs, effectiveness of investments in transportation and productivity of labour.

- **Legal zone of transport coordination:** For smooth coexistence of all means of transportation there is a need to settle all legal matters related to the relations amongst organizations of various kinds of transport and between transport administration and customers, this includes provisions on the reciprocal responsibility of parties to put in place agreements and contracts for transportation. There also needs to be a well laid out coordination in the matters of security, conveyance of cargo and also the multimodal means of transportation.

6.3 COORDINATION AMONG SUPPLY CHAIN PARTNERS

There is a need for a company to develop operational coordination within its boundaries and beyond the realms of its domain so that the potential to convert competitive advantage into profitability is maximised (Dyer and Singh, 1998). Coordination between the rate of order fulfilment to keep up with tangible consumption is successful from the point of view of the customer, if it is able to meet a customer's delivery date and has the capability to lower the logistical costs.

Coordination amongst different firms, such as raw-material dealers, producers, wholesalers, third-party logistics providers and retailers, is very important to attain the required flexibility which enables them to make a progressive improvement in logistics procedures in relation to fast changing market situations. Bad or no coordination among the members of the supply chain can be the cause of a dysfunctional functional performance. Poor or no coordination can lead to many negative consequences such as, higher costs in inventory, longer delivery times, higher costs of transportation, more loss and damage, and poor customer service (Lee et al., 1997). A supply chain, in the field of logistics, is a chain in the literal sense, with the action of one party linked to the other. Thus, the poor performance of any one of the chain members is likely to have a kind of a domino effect on the performance of others. Coordination helps in the management of interdependent logistics activities so that demand unpredictability and excess inventory can be mitigated. A process of preparation, implementation and control of the interdependent activities done by different members of supply chain or business units with the aim to create value for the end consumer is called supply chain management (Lambert et al., 1998).

The ideas of mutuality and emphasis on coordination are implemented to construct a taxonomy of diverse coordination modes. The **notion of mutuality** denotes joining efforts of independent firms towards achieving one common goal, customer

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Supply chain management: It is process of preparation, implementation and control of the interdependent activities done by different members of supply chain or business units with the aim to create value for the end consumer.

Check Your Progress

1. Which factors lead to the selection of interaction between various modes of transport?
2. What brings about an ease in simultaneous mutually beneficial functional coordination of modes of transport?



Notion of mutuality: It is a principle denoting joining efforts of independent firms towards achieving one common goal, customer satisfaction.

satisfaction. Mutuality contains complementarity and consistency of deeds of the chain members, however the emphasis is on highlighting functional and administrative associations. The four modes of coordination which have been identified in the classification are:

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- Logistics synchronisation
- Information sharing
- Incentive alignment
- Collective learning

Generally, the activity of coordination and coordinated decisions refer to separate bodies working in unison for decision alignment with an aim to improve the overall performance. This has been an important point of concern in the early economic theory that separated the firm from its hierarchies and price mechanisms as forms of coordination. When unconnected companies coordinate with each other, it is known as combination or integration. In industrial engineering research perspective and especially in SCM research, the terms cooperation, coordination, and collaboration are generally used interchangeably without clearly differentiating them from each other. This can lead to confusion and uncertainty.

Let us have a look at all these three terms:



Cooperation: It has been defined as performing or working together for a common purpose.



Coordination: It denotes to a more straight and active cooperation.



Collaboration: It is defined as working with someone for a particular purpose or merely just as working with someone.

- **Cooperation** has been defined as performing or working together for a common purpose; working or performing together in the direction of a common end or purpose; being compliant, or working with someone toward a common goal. With regard to SCM, Quiett (2002) has deduced cooperation as 'little more than toleration of each other.' The idea of 'working together' in the perspective of cooperation does not propose a close functional working relationship, rather it suggests, here, a positive attitude towards each other.
- **Coordination** denotes to a more straight and active cooperation. It is defined as 'the act of making arrangements for a purpose,' the 'harmony of various elements,' 'harmonious adjustment or interaction,' and making unconnected things working together. In comparison with cooperation, coordination points towards an interactive, combined decision making course, where unconnected entities influence each other's decisions more directly.
- **Collaboration** has been defined as working with someone for a particular purpose or merely just as working with someone. In the example, collaboration has been basically defined as a substitute for working together. The other two definitions indicate towards common objectives and endeavours. Whereas coordination is primarily conducted by providing the right signals or sharing the right information and the same policies, collaboration specifies a combined, interactive process that culminates in joint decisions and activities.

The Supply Chain Management Framework

Within the framework of Supply Chain Management (SCM), the fundamental SCM model has been labelled, SCM cooperation. It has been seen as a tactical instruction that incorporates coordination and collaboration. The difference between cooperation,

coordination, and collaboration, as important components of SCM has already been discussed in the preceding section.

Supply chain productivity can be holistically maximized when all stages are well coordinated. Thereby, it leads to combined decisions. The importance of coordination has been established by many researchers but a study carried out by Thonemann among manufacturing companies authenticates it optimally. In the research, supply chain coordination has been acknowledged as the topmost success factor for manufacturing companies. It concluded that a supply chain is fully coordinated when all choices or decisions are associated with accomplishment of global system objectives. Information sharing is of fundamental importance for effective coordination, this offers coordinated predictions and projections based on authentic information. Therefore, a lack of coordination happens when decision makers are not equipped with complete information or incentives which are not harmonious with system-wide objectives.

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Chopra and Meindl have measured five classifications of obstacles which hinder coordination and pose a threat to the smooth functioning of the SCM. These include elements that lead to local optimization, an increase in postponement and misrepresentation of information, and variability within the supply chain. The five stumbling blocks are:

(a) **Incentive obstacles:** These are hurdles which arise due to wrong incentives given to members of the supply chain in order to impact their decisions to support global optimization instead of pareto-efficient solutions.

(b) **Information processing hurdles:** These contain orders dependent on predictions rather than customer demand, and a lack of information sharing.

(c) **Operational difficulties:** Lot supplies, rationing and deficiency gaming, and large replacement lead times can be said to be some operational difficulties. The effect of lead times was pointed out which can result in the halving of forecast errors.

(d) **Pricing complications:** Lot dimensions, founded on quantity discounts and price variations contribute immensely to the inconsistencies within supply chains.

(e) **Behavioural problems:** Rules, policies and management practices, like frequency of MRP runs, narrow company perspective and local optimization illustrate this hurdle.



Horizontal coordination mechanism: It is also known as centralization or risk pooling which decreases demand inconsistency in case of demand being combined across locations.

Horizontal coordination mechanism also known as centralisation or risk pooling decreases demand inconsistency in case of demand being combined across locations. It is a way by which safety stock and regular inventory can be condensed in a system. Certainly, some costs might surge, for example, transportation costs or client lead time, so, before taking a decision, these concerns must be evaluated against the benefits.

Coordination Mechanism

Following are some important strategies and coordination mechanisms summarized by researchers:

(a) Price coordination using quantity discounts: Optimization of system is pursued through the positioning of producer's pricing structure with purchasing incentives of a customer in different circumstances, such as volume limitations and availability of different information.

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(b) **Non-price coordination:** This mechanism includes practices like, service regions, quantity forcing, and service variation.

(c) **Buy-back and return policy:** Such policies intend to enhance stocking incentives for consumers, particularly for perishable goods.

(d) **Flexibility of quantity:** Contracts containing flexible quantities, for example, a certain amount of minimum buying by a purchaser and maximum amount of goods made available by way of a supplier, are aimed at sharing the risks of predicted nonconformities.

(e) **Allocation rubrics:** Due to limited capacity resources, consumers might alter their orders, which cause inefficiencies of the supply chain. Under certain circumstances, it is good for a supply chain to not provide honest information about definite order supplies but also note that there might be a change in this with change in conditions, for example marginal cost for capacity or marginal customer costs.

While collaborating two or more units work together, share resources, and strive to attain collective goals. Meaningful relationships are established while collaborating, and this depends on the capacity to trust one another and to realise each other's knowledge. Practice leaders have reported benefits, for example inventory cutbacks, lesser operating charges, and potential profit improvements through coordination and collaboration. It has been stated by Basch that collaborating with channel partners is a strategy which works out to be most effective for producers. Well aware of the benefits of collaboration, many firms are disinclined towards or unable to share sensitive data that could be benefit both parties. They don't want to let go of this kind of information in order to be in an advantageous position in comparison to the other party involved. Such a behaviour can be termed as a lack of trust. This is why it can be said that trust is the most critical component of collaboration.



Integration: In supply chain management, it denotes mainly a seamless material and information flow through all members within a supply chain with the objective of maximizing competitive advantage.

In the smooth functioning of supply chain management, the factor that complements cooperation, coordination and collaboration, is integration. Many scholars while explaining integration tend to augment its meaning beyond the understood the SCM framework. Such a depiction of the term could be due to linguistic reasons, nevertheless it is important to elucidate the differences.

Integration is perceived differently. Coordination and collaboration comprises of interaction and collaboration. Ideas are described as a part of their understanding of integration. On the contrary, integration should be seen as independently having a distinct meaning. The following definition of integration will put things in better perspective: 'To make into a whole by bringing all parts together; unify.' As per this, amalgamation of parts that have once been separate is implied. In the general SCM perspective, there may be a need of this only in some areas, specifically in the material and information flows along supply chain processes. Variety, in contrast to similarity, may be advantageous specially in collaborative efforts, as defined earlier. Consequently, integration denotes mainly a seamless material and information flow through all members within a supply chain with the objective of maximizing competitive advantage.

Check Your Progress

3. What are the consequences of poor or no coordination?
4. List the four most recognized modes of coordination.
5. What is of fundamental importance for effective coordination?
6. Define horizontal coordination mechanism.

6.4 ENERGY PRODUCT PRICES, ENVIRONMENT AND LOGISTICS

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In this section, we will discuss the relation of energy and environmental factors on logistics.

6.4.1 Energy Product Prices and Logistics

In the current scenario, internationalization of domestic economies is on the rise which is providing a boost to energy consumption and trade. Along with this, time sensitivity of customers and their varied demands lead to the disaggregation of B2B (business to business) and B2C (business to customer) shipments. Firms put into practice new business theories such as e-commerce and virtual enterprise, in order to meet these challenges. Tailor-made merchandises are offered at all times, which can be transported to practically any part of the world within a matter of few days. The SMC integration of businesses lead to complexity and dependency on competent and dependable logistics, which is also the base factor causing fluctuations in product prices.

The crude oil price is affected by strategic factors linked to politics, economy, technological development and the environment. These factors comprise the development rate of economies, exchange rates, use of renewable energies, examination of new oil sources and threats such as accidents, war and natural catastrophes. Their interaction causes doubt about the future changes in the oil price, making its forecast a very tough task. With regard to demand and supply, both increasing demand from developing countries, and doubt about available resources at the sources play a vital role in crude oil market development. According to the peak oil theory, availability of crude oil is limited and production will not be able to keep up with demand in the long run.

As crude oil and its by-products come to be incrementally limited, their market price displays a great instability. In July 2008, it touched more than 145 dollars and fell to less than 40 dollars just months after that. In 2011, its price increased by 25 per cent within a time period of four weeks. Nevertheless, models based on supply and demand of crude oil offer neither clarification of historic oil prices nor approximation of oil prices in the future.

One more consequence of swelling transportation volumes is the emission of greenhouse gas. Greenhouse gas productions aggravate global warming and induce climate change. Carbon dioxide is the most prominent greenhouse gas. Between 2000 and 2007, total yearly Carbon dioxide emissions in the EU rose by 1.9 per cent. In the transport sector, however, the emission of Carbon dioxide increased by 7.2 per cent.

Logistic undertakings use warehouses or trans-shipment services to institute logistic networks, which facilitate the regional union of transports for many customers and from different suppliers. By means of freight consolidation, the employment of the means of transportation can be amplified, and therefore, overall transportation distance as well as Carbon dioxide emissions can be reduced.

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Oil Price and Logistics

Let us now try to understand the impact of the oil price on the structure of logistic networks by way of the effect of transport costs on general logistic costs. Besides, let's also try to enumerate the indirect effect of the oil price on the logistics network environmental footprint based on the amount of Carbon dioxide emissions.

Price variation in the market for fuel has a continuously changing effect on logistics, especially in the road transport industry. Quick upsurges in fuel price can have a late and shattering effect on logistics companies, and a sudden decline can cause short-term increase in profit and a rush of competition within the market to offer lowest price to consumers.

1. Impact of oil price rise

As the cost of petrol or diesel rises, transporters have to pick a difficult option to either raise prices or bear losses. The fuel price not only affects the logistics company, but also the transporter and also his profit source. It is an outward ripple effect: If carriage of freight is costing more to the carrier, then obviously the consignor is going to be charged more to make up for the loss. In case where the shipper is going to be charged more for transportation of freight, the consignee may also be, in effect, charged more to make up for their added costs.

The preferred means for transport changes as and when it becomes less financially viable to move freight using fuel inefficient methods relative to the market. For example, if the price of rail use is low and fuel costs are high, it will only be logical for a logistics company to ship more freight using intermodal carriers as compared to moving freight only by road trucks.

This concludes that the merchandises being transported via expensive modes of transport are going to be sold to customers at higher costs in order to make up for the greater transportation and fuel expenditures. Fundamentally, greater fuel costs result in product inflation, and impact every aspect of production transport on its way.

2. Impact of decline in fuel prices

When the fuel cost decreases, generally the opposite happens. The saved expenditures are passed on to the customer in the shape of reduced prices. Demand for transportation services increases as the prices fall. Sales and productivity improve and thus growth is encouraged. Logistics companies that provide the highest cost savings can redirect efforts from alleviating the high costs of fuel to endeavouring to escalate the speed of service and improve other aspects of their functioning.

With the repeated and frequent instability in oil prices, logistics companies are forced to streamline or strategize their processes to guarantee sustained profit, and evade any possible hindrances. The impacts on the logistics industry and the upsurge in freight transportation costs have encouraged some companies to start possessing more inventories at their disposal, minimalizing the amount of necessary transportation. It is often that larger bulk consignments turn out to be more cost effective in comparison to frequent smaller shipments. This may save the consignors' and consignees' money, but causes yet another negative effect on the logistics industry. Lack of shipment frequency escalates the number of empty trips made by a carrier. The more stops a carrier can make in a given route the more profitable the trip.

Generally, logistics companies calculate fuel surcharges dependent on the fuel prices of the preceding week. In case of a rapid rise in fuel prices, there is a gap between the price of fuel and its surcharge rate. This gap has a vast effect on earnings of the transporting company. Nevertheless, when the cost of fuel drops quickly the reverse holds good, and a higher profit is made. Unfortunately the latter occurs much less often. Fuel cost and its impacts are a permanent part of the logistics industry. It makes logistics companies compete among each other more vigorously. All try to work towards having the lowest rates, while making suitable profit.

In the previous decade, research on the instability of crude oil price and on its effect on transport logistics have got a lot of attention. Hamilton studies the dynamics responsible for the fluctuation in prices of crude oil. As most prominent characteristics, he classifies low price elasticity of demand, the sturdy growth in demand from China, the Middle East and other newly industrialized economies, along with the failure of global production to escalate. In his research ahead, he tries to ascertain the impacts of the build-up of oil prices between 2007 and 2008 and preliminary oil price shocks on the US economy. Roeger scrutinises the impact of the permanent oil price increase in the European Union considering output and inflation.

Diesel prices, as one significant factors effecting transport costs within a logistic network, rise quickly ensuing an upsurge in the price of crude oil, but decrease sluggishly after a decrease. The unbalanced response of petrol and diesel prices on the crude oil price has been the focus of numerous studies since 1990.

The subject of cost optimum arrangement of logistic networks under the supposition of linear logistics costs has been thoroughly examined. Melkote and Daskin combine the optimization of locating facility and the basic transportation network centring investment costs. Their findings indicate that it is more economical to invest in few facilities and many links at small investment levels. By increasing budget, they analyse that more facilities and fewer links are adequate. As a consequence, the transport costs decrease within the transportation network.

6.4.2 Environment and Logistics

In the past few decades, the ecological effects of transportation have become a topic of ever growing importance across the globe. Consequently, studies have been carried out to enhance our comprehension of contaminant emissions and their consequences, and to muster schemes for reduction of this undesirable impact. Efforts have been made by some researchers to define the enduring course for future transportation and environmental exploration from a larger perspective. These examinations offer a general framework for the concept of sustainability, describing the reason of studying transportation and the environment, which includes logistics systems and their effects. Furthermore, research has been carried out for the purpose of comprising sustainability in a general framework to steer future logistics planning. Therefore, industry has started to respond and make changes to the increasing need for sustainable activities.

The Environment and Transport

The issue of transportation and the environment is ironic in nature because transportation brings extensive socioeconomic advantages, but at the same time impacts the environment in a negative manner. On one hand, transportation activities provide support

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to growing mobility needs for passengers and freight, while on the other, transport activities are related to growing levels of environmental pollution. The development of individual and cargo mobility in the past few decades has widened the role of transportation as a source of pollution and its multiple effects on the environment. Impacts of transportation on environment can be compartmentalised into three categories:

1. **Direct impacts:** The direct result of transport activities on the surroundings where the cause and effect relationship is usually clear and well understood. For example, noise and carbon monoxide emissions are considered to have direct injurious effects.
2. **Indirect impacts:** The secondary (or indirect) impacts of transport activities on ecological systems. These are generally of greater consequence as compared to direct effects, but the involved connections are usually misconstrued and more difficult to institute. For example, particulates are generally the product of incomplete combustion in an internal combustion engine, these are indirectly connected with respiratory and cardiovascular complications as they contribute among other factors to such circumstances.
3. **Cumulative impacts:** The additive, multiplicative or synergetic results of transport activities. They encompass the wide-ranging impacts of direct and indirect effects on the environment, which are usually unforeseen. Climate change, with intricate causes and results, is the cumulative effect of numerous natural and anthropogenic aspects, in which transportation has a big role to play. 15 per cent of global CO2 emissions are attributed to the transport sector.

The complications of the effects have initiated a lot of controversy in the formulation and amendments of environmental policy, the role of transportation and alleviation strategies. The transport sector is frequently subsidized by the public sector, specifically through the construction and maintenance of road infrastructure, which happen to be free of right to use. At times, public incentives in transport modes, terminals and infrastructure can be contradictory to environmental interests. In situations where, the initiator and the controller are the same (different branches of the government), then there is a possibility that rules and procedures will not be completely obeyed.

Total costs sustained by transportation activities, especially environmental loss, are generally not fully assumed by the users. The lack of contemplation of the real costs of transportation could elucidate numerous environmental glitches. Nevertheless, a complicated ladder of costs is involved, vacillating from internal (mostly operations), compliance (abiding to regulations), contingent (risk of an event such as a spill) to external (assumed by the society). For example, external costs account on average for more than 30 per cent of the projected vehicle costs. In case of non-inclusion of environmental costs in this assessment, the usage of the car is consequently subsidized by people and costs also result in environmental pollution. This issue needs to be squarely addressed as the number of automobiles, especially cars, is gradually on the rise.

Transport and the environment share a multidimensional relation. Some features are unidentified and some new conclusions may lead to radical changes in environment related policies, as it did with respect to acid rain and chlorofluorocarbons in the 1970s and 1980s. The 1990s were categorised by an awareness of global environmental

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problems, exemplified by the growing worries between anthropogenic impacts and climatic change. Transport industry also came to be a vital aspect of the theory of sustainability, which has turned into a main focus of transport activities, ranging from emissions by vehicle to green supply chain management adherences.. These looming developments need a profound understanding of the mutual effect of the environment and transport infrastructures on each other, yet this understanding is frequently missing. The chief factors deliberated in the physical environment are geographical position, landscape, physical structure, climate, hydrology, earth, natural vegetation and animal life.

The environmental extents of transportation are associated with the causes, the activities, the outcomes and the consequences of transport systems. Creating connections between environmental proportions is a difficult task. For example, what is the extent to which carbon dioxide emissions are linked to land use forms? In addition, transportation is deeply rooted in environmental cycles, particularly over the carbon cycle where carbon moves from one component of the biosphere, such as the atmosphere, to another such as the ecosphere, where it can be collected (permanently of temporarily) or passed on. The relations between transport and the environment are also made complex due to the following two clarifications:

1. **Level of contribution:** Along with other anthropogenic and natural causes transport activities play a direct, indirect and cumulative role in enhancing environmental problems. In certain cases, they may be a main cause, while in others they may have a marginal role that is not very easy to ascertain.
2. **Scale of the effect:** Transport activities add to the environmental problems at different geographic scales. The scales range from local (noise pollution and carbon emissions) to global (climate change), and also at continental / national / regional scales, e.g., problems like smog and acid rain.

Therefore, those instituting environmental policies for transportation have to consider the level of contribution of transportation and the geographic scale, or else some policies may just take the problems somewhere else and have unintentional consequences. A well-known example in this regard are the environmental policies of developed economies stirring the repositioning of some activities with high environmental dangers (e.g. steel making). As a consequence, to the compliance of such a policy, the problem is transferred from one place to another. Such relocations entail new equipment and technologies that are usually less impacting

The network structure of the transportation industry, the methods used and the levels of traffic are the chief factors responsible for creating the impact of transportation on environment. Networks effect the spatial dispersal of emissions, whereas modes are related to the type of the emissions and lastly the traffic decides the intensity of these emissions. Moreover these environmental influences, economic and industrial processes supporting the transportation systém must be taken into consideration. These include the drawing out and production of fuels, vehicles and construction tools and material, some of which are highly energy intensive (e.g. aluminium), and the disposal of automobiles, parts and the facility of infrastructure. They all have a life cycle scheduling their manufacture, use and disposal. Thus, the assessment of the relation between transportation and the environment without the taking into consideration these cycles in the environment and in the product life alike will probably present a myopic overview

of the situation and may even lead to incorrect evaluation, strategies and mitigation policies.

Environmental Dimensions

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Increased transport activities have caused an immense growth in the motorization and congestion levels. Consequently, the transport sector has become one of the main culprits of environmental problems. Following are some important environmental effects caused by transportation:

- **Climate change:** The activities of the transport industry discharge several million tons of gases into the atmosphere every year. These emissions are the main cause of such drastic changes occurring in the climatic conditions. Just as transport system is effecting the climate change, similarly, change in climatic conditions also has a substantial effect on transportation systems, predominantly infrastructure (e.g. floods) and processes (changes in weather).
- **Air quality:** Vehicles moving on the roads, marine ships, trains and aircrafts are all sources of pollution, they emit certain gases and particulates that have negative effects on the atmospheric air quality, in turn damaging human, plant and animal health. Toxic air pollutants have been known to be cause of cancer, cardiovascular, respiratory and neurological diseases. The physical and chemical properties of particulates cause ghastly health risks like respiratory problems, skin diseases, eyes irritations, blood clotting and different types of allergies.
- **Noise:** Noise signifies the overall effect of uneven and disorderly sounds on life of people as well as animals. Fundamentally, noise means an undesirable sound. Long term contact with loud noise levels (above 75 decibels) seriously obstructs hearing and has a negative effect on general wellbeing of human beings. Noise originating from the movement of vehicles on roads and the happenings at sea ports, airports and railway stations effects human health, through an increased risk of cardiovascular diseases.
- **Water quality:** Transport activities have a negative impact on hydrological conditions and water quality. Fuel, chemical and other harmful particulates emitted from aircrafts, cars, trucks and trains or from sea port and airport terminal operations tend to pollute hydrographic systems. With an increase in demand for maritime shipping, marine transport releases characterise the most significant segment of water quality impact of the transport sector. The key effects of marine transport processes on water quality principally arise from rummaging, waste, ballast waters and oil spills. Major oil spills from oil cargo container accidents pose the most serious problems of pollution from maritime transport activities.
- **Soil quality:** Transport system has had negatively impacted the quality of soil; soil erosion and soil contamination are the main outcomes of this impact. Coastal transport services have substantial effect on soil erosion. Shipping activities are regularly changing the scale and range of wave actions damaging confined channels for example river banks. Construction of highways or reducing surface grades for construction of ports and airports has led to loss of important fertile land.

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- **Biodiversity:** Transportation also effects biodiversity. The need for construction and the expansion of land-based transportation has led to cutting of trees. Many transport routes have led to reduction of wetland areas and driving-out water plant species. Many animal species are vanishing because of changes in their natural habitats and reduction of ranges.
- **Landscape:** Transportation facilities have had an impact on the urban landscape. The development of airport and railway infrastructure is an important feature of the urban environment. Social and economic cohesion can be cut off when new transport facilities like raised train and highway structures move through an established urban community. Highways or transportation terminals can describe urban borders and produce isolation.

  Major transport facilities can have an adverse effect the quality of urban life by forming physical barriers, escalating noise levels, producing smells, diminishing urban aesthetic and affecting the constructed heritage.

6.5 PROBLEMS AND PROSPECTS IN INTERSTATE LOGISTICS BY ROAD

Road transportation is a significant link in the supply chain that enables productivity and competitive effectiveness, which leads to the economic development of a country. It also plays an important role in stimulating the growth and expansion of the remote areas by initiating trade and investment in those regions and assimilating them with the actual economy. In spite of its significance the transport sector in India has got very little attention. The insufficiency of transport infrastructure and absence of funding from government have been the prime cause of the problem facing the road transport and cargo sector. Transportation in India is one segment of the total supply chain in the country today with extreme potential to save costs. It can be heightened to a level where every partner in the business would secure benefits and will be able to harness its future.

Logistics sector in the country is still mostly disorganised. Almost 70 per cent of the trucks operated in India belong to transporters with a fleet size of less than six trucks. Transportation for metal or steel industry companies is hugely important but the same lacks organisation and systemization, actually the problem is that they are always trying to cut costs, trying various methods.

Transport for an FMCG industry is also very challenging, because these kind of products have to travel various levels and the hardest challenge is faced at the last step, i.e., to make the product reach its retail outlet. Cancellations, because of routine problems such as unavailability of trucks for carriage, driver problems and ecological factors present numerous supply chain risks. FMCG companies have a capability of saving about 0.5-0.7 per cent of sales by means of improvements in transport and distribution. The last mile delivery issues faced by these companies arise because of the ever growing congestion of the urban roads in India, which have led to delayed delivery time and consequently lowered service levels.

Refrigerated trucks carrying perishable food products are a common sight in the western parts of the world. The forecast for such refrigerated food market had

Check Your Progress

7. Name the business practices brought in by firms to meet the challenges of time sensitivity of customers and their varied demands.
8. Give an example of indirect impact on environment.
9. What are the chief factors of roadways industries impacting the environment?

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been amazingly high. The cold chain has yet to catch up in India with its counterparts in the western world, although India is a pretty hot country to begin with. To fulfil the requirement of cold stores, a very important part of cold chain required to do the job is cold trucks. Refrigerated trucks are really crucial as every year losses are endured by companies not having adequate infrastructure of cold warehouses and cold trucks. The bad condition of our roads adds up to the problem of inadequate fleet of refrigerated for cold food manufacturing and packaging companies. Many companies for example, Nestle, Mondelez marketing confectionary products and also smaller companies are trying to build up a good foundation for cold chains as a whole in the country.

India is proud to have the second largest road network in the world, spreading over 4.7 million kilometres, which makes it the main mode of inland transportation in the country. As we have learnt earlier, the roads in India carry over 60 per cent of the country's entire freight traffic and around 85 per cent of the passenger traffic. Well, though this sounds good to the ears but the fact of the matter is that, the state of Indian roads is really not up to the mark. Let us take a moment to estimate the volume of road freight growth in the country and the parallel growth in the development of the country's road network. Though road freight bulk and the number of road vehicles have been increasing at a compounded annual growth rate of 9.1 per cent and 10.8 per cent respectively, the growth rate of length of roads is way behind at just 4 per cent.

Besides this, most of the road network in the country is rural based which does not allow the smooth transportation of heavy trucks and lorries used for transporting goods through states. The portion of tollways/expressways and national highways in the overall road network is extremely bad in comparison with many developing and developed countries. India has only 1.7 per cent of its entire road network in the shape of expressways and highways, whereas the corresponding figure for the US is 5.7 per cent, UK – 12.6 per cent, South Korea – 16.9 per cent and China 2.6 per cent. This causes reduced truck speeds and postponements in transportation of goods from one state to another.

Other than lack of worthy physical infrastructure, the regulatory structure in India is also one of the reason for numerous delays in road transportation. The trucks moving on India's roads spend only around 40 per cent of their time progressing their journey. The rest of the time, in fact, is eaten up at checkpoints and tollgates. A McKinsey report and an EY summit with FICCI confirms that India spends nearly 13 per cent of its GDP on logistics.

Vehicles are often stalled for checking necessary documents, like sales tax, payment of market fee, octroi, entry permits, law and order concerns, protection of environment and the endangered species etc. Further, there are many other causes owing to a variety of legal provisions that can stop a vehicle, like check on the movement of essential commodities, food adulteration and hazardous chemicals etc. These checks are usually carried out by respective organisations at distinct points, causing many unnecessary stops thus delaying the vehicle.

With a view to improve inter-state trade within the country and make India a business centre, it is imperative to mend the structural infrastructure and procedures lacunas, both, with regard to the road quality and the number of regulatory stoppages caused by checking of vehicles.

Prospects

The road transport industry is extremely disjointed and mostly unorganised. The unorganised segment makes up about 80 per cent of the market share. Nevertheless, change in policies with respect to tax arrangement will probably provide a competitive advantage to the organised sector. Road transport consists of freight as well as passenger traffic.

In the past, the development of the road freight trade was reinforced by the continuing investments in road infrastructure, which will be the driving force for the growth of this sector in the future also. In the eleventh five year plan, 3.6 trillion investments were outlined, which were used in development and re-development of road infrastructure throughout the country. These developments largely reduced the transportation time between various places. Better road infrastructure also helped in lowering the maintenance cost for transporters as there was less wear and tear of their vehicles. With the twelfth five year planning drawing to a close, road transportation has enhanced to reach a newer level of improvement and efficiency.

Additionally, it was proposed that there be a gradual phasing out of CST to further reduce burden of multiple taxes. CST are taxes levied on cargo vehicles moving on the highways, both by the centre and state. The proposal meant to eradicate CST was aimed at providing a competitive edge to suppliers catering to markets across regions. This move would also prove beneficial for as burden of taxes would mean reduced retail prices. With a decrease in rates of merchandises there will be an increased demand for goods, and to fulfil these demands there will be need or transportation for carrying finished goods to dealers and from there to consume, thus the transport industry will boom. In July 2017, the Government of India, introduced the GST or Goods and Services Tax meant to subsume and eliminate the cascading effect of multiple taxes with the aim to reduce the complexities and promote a 'one nation, one tax' principle.

Key Trends Effecting the Logistics Industry in the Future

Globalization

Developing and mature international markets are today part of the growth strategy of a large number of companies. Trends prevalent in the international markets are bound to have a cascading effect on domestic markets and, in turn, inter-state logistics. Logistic solution companies play a major role in facilitating this trend through their transportation network.



Globalization: It is the free movement of goods, services and people across the world.

Patterns of Growth

The future growth of the logistics industry is very volatile. Rather, it will not be wrong to call it unpredictable and fragmented. The growth of inhabitants and economies is likely be concentrated in and around cities. With infrastructure becoming a crucial growth determining factor, the growth in need of transportation can be anybody's guess. Thus, we can say that with the development of cities, development of road transport logistics is also bound to grow and expand.

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Consumers' Behaviour

The logistics industry has been greatly impacted by the arrival of e-Commerce. As a response to this, supply chain management has taken a completely different turn and is working hard to meet the needs of the consumer. Completion practices must be accustomed by businesses in order to cope with the present changes whereas at the same time working on a B2B supply chain that is inexpensive. Furthermore, they will have to deal with illogicality and dissatisfaction of consumers who expect more than one delivery option - last-mile services, same day and next day deliveries - and still 67 per cent of them select the slowest and cheapest mode of deliver.

Uberization of Trucking

Drive sharing has been a fairly successful venture in the taxi business and some trucking companies are hoping for a similar change in the trucking industry as well. There is already a move in existence with this respect, where companies are offering Uber-like services along with apps. This venture rests on the idea of giving customers more control of transportation and inventory since they are very keen on more and more visibility. Some of the latest freight apps (being used in the developed countries) allow shippers to find out which trucks are close to their location and then book one directly without having to go through the hassle of contacting a broker. The driver of the truck assesses the space required for the client's goods by using scale/weighing system attached in his truck, to ensure that there is enough room for the stuff. Such a progressive move in the trucking industry can revolutionise the industry manifold.

Thus we can easily say that in the next ten years, there is going to be aggressive growth in the, already so advanced, road transport logistics system. These advanced systems will also be equipped to connect better with the environment. Technologically savvy workers will be able to operate intelligent machinery working along with self-directed forklifts and robots in highly automated operations. With every activity leaving behind a digital footprint, supply chains will be more dependable, well-organized and inexpensive.

6.5.1 Role of Truckers' Bodies in Road Cargo Movement

All kinds and sizes of businesses depend on the transportation industry for maintaining fast delivery times and ensuring safe delivery of products all across the nation. The trucking industry transports much more cargo in comparison to trains, ships or airplanes. Besides, without the help of road transport, how would goods travel to and fro from rail yards, ports and airports to the distributor or the consumer? In case of a failure in the trucking industry of a nation, undoubtedly the economy come to a standstill.

Contribution of the Trucking Industry

Crucial Responsibilities

The first economic contribution made by the trucks is the delivery of raw materials to producers. For instance, trucks carry raw materials from local contractors, such as mines, quarries, farms, and loggers, to manufacturing plants that need such materials in order to make finished products. Finished goods then is then transported on trucks to wholesalers and retailers, or to other transportation channels to be further moved by ship, airplane, or train to destinations around the region, the country, or the world.

Multiplicity of Goods

Practically, all kinds of goods are transported by trucks from one point or another. Transported goods include agrarian and fish products, furniture, stone and minerals, motor vehicles, wood, textiles, leathers, coal, petroleum, to say, just about every category of product that exists in the world is carried by trucks.

Employment

Small trucking businesses often operate on a model wherein generally the truck driver is self-employed. Larger trucking businesses frequently employ union drivers. Just as trucking associations safeguard the trucking industry's wellbeing as a whole, unions work in order to protect the interests of the drivers. Such unions and associations can have a gigantic effect on the economy. A single large-scale strike is powerful enough to bring the economy to a halt, causing shipping delays and colossal price increases as supplies fight to meet the rising consumer demand.

Political Influence

Keeping in view the humungous size and utmost importance of the trucking industry, national and state governments impose many regulations. For instance, to ensure public safety on the roads, there are laws in force that limit trucks from using certain roads, there is a restriction on trucks passing through many cities during morning traffic hours, trucks are also required to observe lower speed limits, and prevent truck operators from driving without adequate rest. To help in shaping the policy and control the community image of trucking, members of truckers' bodies and organisations work in unison to establish best practices and industry-wide standards. Often it has been seen that trucking associations, of certain countries have a significant political clout making them an important player in political decisions.

6.6 SUMMARY

Some of the important concepts discussed in this unit are:

- The collaboration between various means of transportation for their involvement in the unified transportation procedure is to guarantee management and effective collaboration of the technological processes for all the stakeholders.
- Balanced collaboration of various means of transportation then lays the foundation for the operational working of the country's cohesive transportation system.
- The level of expansion and growth of transport organization; the aspiration to lessen the cost of transport and to escalate the speed of delivery in market conditions are the factors which lead to the selection of interaction between various modes of transportation. The selection ultimately aimed to serve the needs of specific freight or passenger flow.
- Undesirable rivalry amongst different means of transport can be removed by the way of coordination amongst railway and roadways; shipping and airways. Existing competition amongst these means of transportation is the main limitation of the development of transport sector.

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Check Your Progress

10. What is the cause for last mile delivery issues faced by FMCG companies in India?
11. State one of the most important requirement of cold stores.
12. Other than lack of worthy physical infrastructure, what is another reason for numerous delays in road transportation in India?

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- The aim of striking a coordination amongst different means of transport is the ability to make joint use of a country's transport resources and potential in a way that maximum benefits can be derived from each kind of transport, depending on the intrinsic advantages of each as revealed in operational costs and standards of service.
- Procedures and methodologies of coordination among different means of transport is not limited to any one field, rather it relates to the technical, technological, organisational, economic and legal fields. Let us have a look at the reasons why:
- Coordination amongst different firms, such as raw-material dealers, producers, wholesalers, third-party logistics providers and retailers, is very important to attain the required flexibility which enables them to make a progressive improvement in logistics procedures in relation to fast changing market situations.
- A supply chain, in the field of logistics, is a chain in the literal sense, with the action of one party linked to the other. Thus, the poor performance of any one of the chain members is likely to have a kind of a domino effect on the performance of others. Coordination helps in the management of interdependent logistics activities so that demand unpredictability and excess inventory can be mitigated.
- The four modes of coordination which have been identified in the classification are: Logistics synchronisation, Information sharing, Incentive alignment and collective learning.
- Supply chain productivity can be holistically maximized when all stages are well coordinated. Thereby, it leads to combined decisions. Horizontal coordination mechanism also known as centralisation or risk pooling decreases demand inconsistency in case of demand being combined across locations. It is a way by which safety stock and regular inventory can be condensed in a system.
- In the smooth functioning of supply chain management, the factor that complements cooperation, coordination and collaboration, is integration.
- In the current scenario, internationalization of domestic economies is on the rise which is providing a boost to energy consumption and trade. Along with this, time sensitivity of customers and their varied demands lead to the disaggregation of B2B (business to business) and B2C (business to customer) shipments. Firms put into practice new business theories such as e-commerce and virtual enterprise, in order to meet these challenges.
- The issue of transportation and the environment is ironic in nature because transportation brings extensive socioeconomic advantages, but at the same time impacts the environment in a negative manner. On one hand, transportation activities provide support to growing mobility needs for passengers and freight, while on the other, transport activities are related to growing levels of environmental pollution.
- Contribution of the Trucking Industry include: the delivery of raw materials to producers; self-employment in cases of small trucking businesses and union drivers in case of larger trucking businesses frequently employ union drivers; and keeping in view the humungous size and utmost importance of the trucking industry, national and state governments impose many regulations.

6.7 ANSWERS TO 'CHECK YOUR PROGRESS'

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1. The level of expansion and growth of transport organization; the aspiration to lessen the cost of transport and to escalate the speed of delivery in market conditions are the factors which lead to the selection of interaction between various modes of transportation.
2. Following a procedure of notification and regulation of sourcing rolling stock to the loading/unloading sites and trans-shipment of goods in transport nodes brings about an ease in simultaneous mutually beneficial functional coordination of modes of transport.
3. Poor or no coordination can lead to many negative consequences such as, higher costs in inventory, longer delivery times, higher costs of transportation, more loss and damage, and poor customer service (Lee et al., 1997).
4. The four modes of coordination which have been identified in the classification are:
   - Logistics synchronisation
   - Information sharing
   - Incentive alignment
   - Collective learning
5. Information sharing is of fundamental importance for effective coordination, this offers coordinated predictions and projections based on authentic information.
6. Horizontal coordination mechanism also known as centralisation or risk pooling decreases demand inconsistency in case of demand being combined across locations. It is a way by which safety stock and regular inventory can be condensed in a system.
7. Firms have into practice new business theories such as e-commerce and virtual enterprise, in order to meet the challenges of, time sensitivity of customers and their varied demands.
8. An example of indirect impact on environment are particulates, the product of incomplete combustion in an internal combustion engine, which are indirectly connected with respiratory and cardiovascular complications as they contribute among other factors to such circumstances.
9. The network structure, the methods used and the levels of traffic are the chief factor of the of the transportation industry responsible for creating the impact of transportation on environment. Networks effect the spatial dispersal of emissions, whereas modes are related to the type of the emissions and lastly the traffic decides the intensity of these emissions.
10. The last mile delivery issues faced by FMCG companies arise because of the ever growing congestion of the urban roads in India, which have led to delayed delivery time and consequently lowered service levels.
11. To fulfil the requirement of cold stores, one of the most important part of cold chain required to do the job are cold trucks.

12. Other than lack of worthy physical infrastructure, the regulatory structure in India is also one of the reason for numerous delays in road transportation.

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6.8 QUESTIONS AND EXERCISES

Short-Answer Questions

1. What do you mean by the concept of coordination among different modes of transport?
2. List the guidelines for developing transport coordination policy (with special reference to developing countries.
3. Differentiate cooperation, coordination and collaboration.
4. Briefly describe the impact of increasing and decreasing oil supplies.
5. Discuss the problems in interstate logistics by road.

Long-Answer Questions

1. Describe the procedures and methodologies of different areas of coordination among different means of transport.
2. Discuss the concept of supply chain management framework in reference to the modes of transport.
3. Examine the relationship between energy product prices and logistics.
4. Assess the environment and its impact on transport logistics.
5. Explain the key trends effecting the logistics industry in the future.
6. Describe the role of truckers' bodies in road cargo movement.

Master of Business Administration

M.B.A. (Logistics Management)
Paper 3.5

Rail-Road Logistics





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